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DAVID W TAYLOR NAVAL SHIP RESEARCH AND DEVELOPMENT CE--ETC F/6 13/10  
FEASIBILITY MODEL OF CASDAC LEVEL IV/V TOP-DOWN ANALYSIS.(U)  
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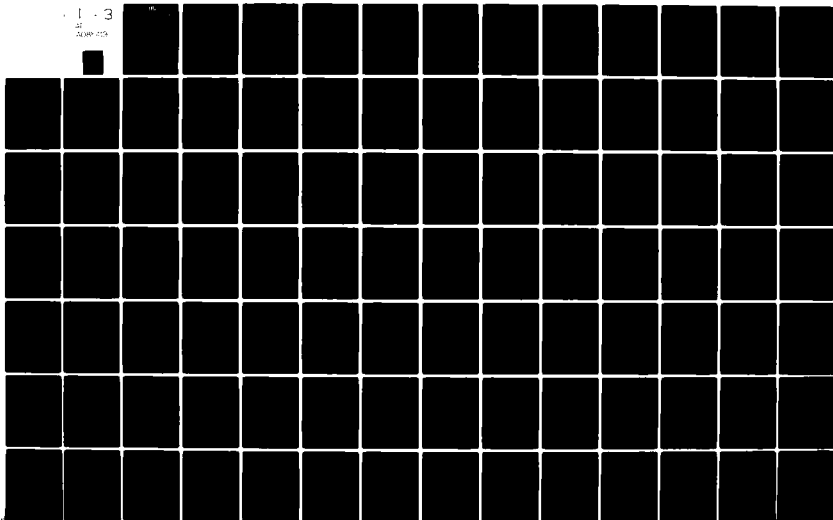
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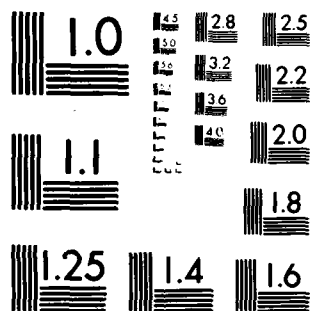
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FEASIBILITY MODEL OF CASDAC LEVEL IV/V TOP-DOWN ANALYSIS

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**DAVID W. TAYLOR NAVAL SHIP  
RESEARCH AND DEVELOPMENT CENTER**

Bethesda, Md. 20084



FEASIBILITY MODEL OF  
CASDAC LEVEL IV/V  
TOP-DOWN ANALYSIS

by

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David W. Taylor Naval Ship Research and Development Center

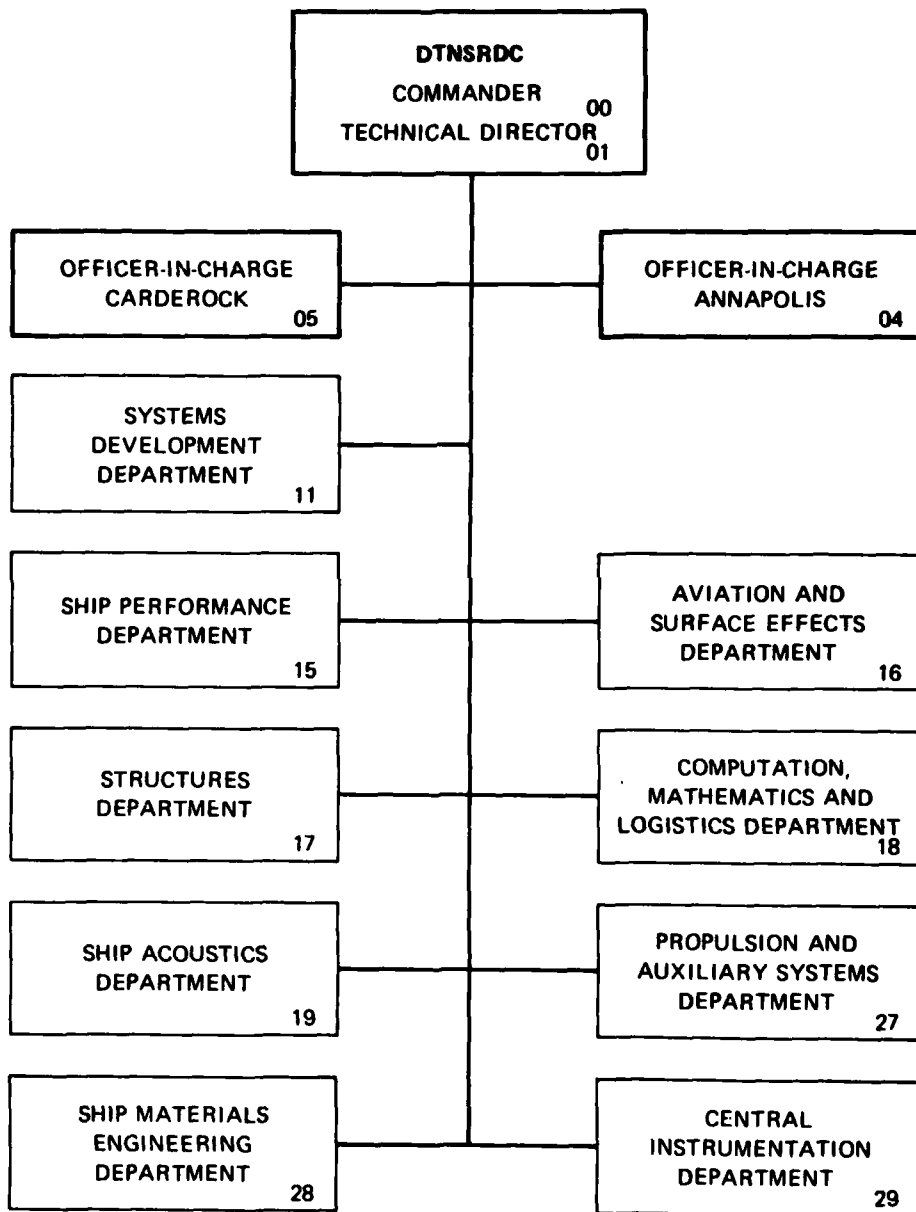
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| 14 REPORT DOCUMENTATION PAGE   |                                     | READ INSTRUCTIONS<br>BEFORE COMPLETING FORM   |  |
|--|-------------------------------------|---|--|
| 1. REPORT NUMBER<br>DTNSRDC CMLD-79-06   | 2. GOVT ACCESSION NO.<br>AD-A085749 | 3. RECIPIENT'S CATALOG NUMBER<br>9  |  |
| 6. TITLE (and Subtitle)<br>Feasibility Model of CASDAC Level IV/V Top-Down Analysis.   |                                     | 5. TYPE OF REPORT & PERIOD COVERED<br>Final report.   |  |
| 7. AUTHOR(s)<br>10. R. Jenkins and B. M. Thomson   |                                     | 6. PERFORMING ORG. REPORT NUMBER  |  |
| 9. PERFORMING ORGANIZATION NAME AND ADDRESS<br>David W. Taylor Naval Ship R&D Center (Code 1853)<br>Bethesda, Maryland 20084   |                                     | 8. CONTRACT OR GRANT NUMBER(s)<br>16/F-35301  |  |
| 11. CONTROLLING OFFICE NAME AND ADDRESS<br>Naval Sea Systems Command (Code 03R2)<br>Department of the Navy<br>Washington, D. C. 20362  |                                     | 10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS<br>RDT&E Element 62760N; Task Area SF53532301; Task 14507 |  |
| 14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)  |                                     | 12. REPORT DATE<br>11 April 1979  |  |
|  |                                     | 13. NUMBER OF PAGES<br>249  |  |
|  |                                     | 15. SECURITY CLASS. (of this report)  |  |
|  |                                     | 15a. DECLASSIFICATION/DOWNGRADING SCHEDULE  |  |
| 16. DISTRIBUTION STATEMENT (of this Report)<br>APPROVED FOR PUBLIC RELEASE; DISTRIBUTION UNLIMITED   |                                     |   |  |
| 17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)   |                                     |   |  |
| 18. SUPPLEMENTARY NOTES  |                                     |   |  |
| 19. KEY WORDS (Continue on reverse side if necessary and identify by block number)<br>CASDAC Level IV HIPO Model<br>CASDAC Level IV Top-Level Functions  |                                     |   |  |
| 20. ABSTRACT (Continue on reverse side if necessary and identify by block number)<br>This study defines the "top-level" functional structure of CASDAC (Computer-Aided Ship Design and Construction) Level IV/V. The definition is accomplished by using a hierarchically structured modeling technique to examine the top levels of each of the six individual functional systems which have been identified as the principal components of CASDAC Level IV/V. These six functional systems address the following areas of ship design and construction: Hull (HULDAC); Machinery (CAMDAC); Piping (CAPDAC); Electrical/Elec- |                                     |   |  |

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20. tronics (ELXDAC); Heating, Ventilation, and Air-Conditioning (CAVDAC); and Handling (HANDAC). The study was restricted to the top three functional levels from a total potential of perhaps ten levels. The study identifies the areas of responsibility of the individual functional systems, identifies data within these systems, and examines the interfaces between the detail design functional systems and Level III subsystems. Data were gathered, organized, and presented for each of the functional systems using the Hierarchical Input Process Output (HIPO) methodology. These HIPO diagrams comprise the core of this study and were used in developing the findings and recommendations.

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## LIST OF ABBREVIATIONS

The extensive use of abbreviations in this study resulted from the fact that the principal work is the set of diagrams found in Appendix A. The presentation of the large amount of information in diagrammatic form has led to the extensive use of abbreviations, many of which are non-standard. The abbreviations used in this study will, in general, comply with MIL-STD-12. Abbreviations not found in MIL-STD-12 were derived by consulting the Master Index of APL's, Webster's Dictionary, and other department references.

|       |                                |
|-------|--------------------------------|
| adv   | advanced                       |
| a/c   | air conditioning               |
| anal  | analysis                       |
| arr   | arrangement                    |
| aux   | auxiliary                      |
| BM    | bill of material               |
| calc  | calculation                    |
| cat   | catalog                        |
| circ  | circulating                    |
| compt | compartment                    |
| C & A | compartment and access         |
| CFE   | contractor-furnished equipment |
| ctrl  | control                        |
| dk    | deck                           |
| dkhs  | deckhouse                      |
| des   | design                         |
| det   | detail                         |
| div   | division                       |
| doc   | document                       |
| docn  | documentation                  |
| dwg   | drawing                        |
| elem  | elementary                     |
| enr   | engineering                    |
| equip | equipment                      |
| exch  | exchanger                      |
| expan | expansion                      |
| fdn   | foundation                     |
| fr    | frame                          |
| FAS   | fueling at sea                 |
| FS    | functional system*             |
| gen   | general                        |
| gnd   | ground                         |

---

\* The term "functional system" as used extensively in this document to describe the six subsystems of CASDAC Level IV/V has since been changed to "engineering system".

|         |                                     |
|---------|-------------------------------------|
| HIPO    | Hierarchical Input-Process-Output   |
| integ   | integration                         |
| instr   | instruction                         |
| isom    | isometric                           |
| lbl     | label                               |
| ltrs    | letters                             |
| lvl     | level                               |
| ltg     | lighting                            |
| L/M     | list of material                    |
| loc     | location                            |
| machy   | machinery                           |
| mn      | main                                |
| mfg     | manufacturing                       |
| matl    | material                            |
| MIC     | material identification and control |
| misc    | miscellaneous                       |
| mld     | molded                              |
| mg      | motor generator                     |
| perf    | perform                             |
| pl      | plate                               |
| plat    | platform                            |
| pwr     | power                               |
| prel    | preliminary                         |
| proc    | procedures                          |
| procr   | procurement                         |
| prod    | production                          |
| QA      | quality assurance                   |
| red     | reduction                           |
| RAS     | replenishment at sea                |
| repr    | representing                        |
| reqmt   | requirement                         |
| rm      | room                                |
| sch     | schedule                            |
| schem   | schematic                           |
| sel     | selection                           |
| SIB     | ships information book              |
| SS      | ships service                       |
| shr     | shower                              |
| spec    | specification                       |
| std     | standard                            |
| stiff   | stiffener                           |
| str     | structural                          |
| struct  | structure                           |
| sum     | summary                             |
| suprstr | superstructure                      |
| sys     | system                              |
| tech    | technical                           |
| vent    | ventilation                         |

## ABSTRACT

This study defines the "top-level" functional structure of CASDAC (Computer-Aided Ship Design and Construction) Level IV/V. The definition is accomplished by using a hierarchically structured modeling technique to examine the top levels of each of the six individual functional systems which have been identified as the principal components of CASDAC Level IV/V. These six functional systems address the following areas of ship design and construction: Hull (HULDAC); Machinery (CAMDAC); Piping (CAPDAC); Electrical/Electronics (ELXDAC); Heating, Ventilation, and Air-Conditioning (CAVDAC); and Handling (HANDAC). The study was restricted to the top three functional levels from a total potential of perhaps ten levels. The study identifies the areas of responsibility of the individual functional systems, identifies data within these systems, and examines the interfaces between the detail design functional systems and Level III subsystems. Data were gathered, organized, and presented for each of the functional systems using the Hierarchical Input Process Output (HIPO) methodology. These HIPO diagrams comprise the core of this study and were used in developing the findings and recommendations.

## GENERAL

### ADMINISTRATIVE INFORMATION

Authorization and funding for this work were given under RDT&E element number 62760N, task area SF 53532301, task 14507.

### ACKNOWLEDGMENTS

This study was conducted by a team of individuals at the David W. Taylor Naval Ship Research and Development Center (DTNSRDC) representing each of the CASDAC (Computer-Aided Ship Design and Construction) Level IV/V functional systems. This team jointly decided the course and direction of the study and individually prepared the material included herein. This acknowledgment is in grateful appreciation of the efforts of the following team members:

|                 |           |
|-----------------|-----------|
| Jack Brainin    | Code 1851 |
| Harry Sheridan  | Code 1854 |
| Jack Lynch      | Code 1854 |
| Ray Brengs      | Code 1855 |
| Murle Henderson | Code 1855 |
| Mark Skall      | Code 1856 |
| Joan Bowden     | Code 1856 |

### BACKGROUND

The Computer-Aided Ship Design and Construction (CASDAC) project currently under development by the Navy is intended to provide improved ships and ship systems at reduced cost in a shortened acquisition time frame. These highly desirable goals can be approached by systematically developing and applying computers and computer-based technology to all phases of the ships acquisition process.

Within CASDAC, the ship acquisition process is described in a five-level breakdown divided into two stages. Early-stage design consists of Levels I, II and III, which correspond to concept, preliminary, and contract design phases. These phases can be characterized by the development and production of cost and feasibility studies, performance trade-offs, hull form definitions, systems definition/selection, and specification generation. The end product of this stage of design is a contract guidance bidder's package which serves as input, guidance, and contractual specification for development of the ship detail design. Programs comprising this stage are being developed and utilized by the Naval Ship Engineering Center (NAVSEC).

The second stage consists of Levels IV and V, which are the detail design and construction phases. These phases use the output of Level III to develop ship arrangements, detail working drawings, documents required to select and procure ship components, various lists, and miscellaneous information necessary for construction and testing of the ship and ship systems. Programs supporting this stage are being developed by the David W. Taylor Naval Ship Research and Development Center. These programs will be employed by shipbuilders under contract to the Navy.

The subject of this study is the development of Levels IV and V of CASDAC.

## STUDY CONDUCT

### OVERVIEW

This top-down study addresses the second stage of CASDAC, which has been defined as Levels IV and V, the detail design and construction phases of the ship acquisition process.

Current in-house studies relating to CASDAC Level IV/V define this level as being comprised of six functional systems. These functional systems address hull (HULDAC); machinery (CAMDAC); piping (CAPDAC); electrical/electronics (ELXDAC); heating, ventilation, and air-conditioning (HVAC); and handling (HANDAC).

The piping functional system, CAPDAC, has conducted and completed an engineering analysis (Reference 1). The hull functional system (HULDAC) engineering analysis report currently under development and the electrical/electronics (ELXDAC) engineering analysis, Reference 2, are not yet complete. Work on the remaining functional systems is negligible.

These individual functional systems until now have been progressing along their own development lines with no formal review respecting standardization of their approaches or concern for future integration. No effort has been previously attempted to examine the interactions among the functional systems, or between them and the CASDAC Level III subsystems.

This study will examine these interactions and attempt to define clear interfaces, to define the scope of each functional system, and to identify potential common software areas. The study was not intended to be an exhaustive, comprehensive investigation. It was anticipated that the top-level structure of each functional system could be examined to a depth of two to three functional levels, depending on the rate of expenditure of limited funds.

### OBJECTIVES

The detailed objectives of this study were identified after much deliberation and many discussions by the top-down study team and the final list was chosen considering the desirability of maintaining some degree of consistency with other current and future development tasks.

The objectives listed below were ordered in the sequence of their preferred accomplishment, so that the more valuable answers would be obtained first.

1. To define the scope of CASDAC Level IV/V.
2. To define areas of responsibility of each Level IV/V functional system.
3. To identify and describe data interfaces among functional systems.
4. To identify and describe data interfaces between Level III CASDAC and each Level IV/V functional system.
5. To identify areas of software development which are applicable to two or more functional systems or Level III subsystems.
6. To identify typical data of each functional system.
7. To define/clarify the Level IV/Level V interface.
8. To produce principal inputs to the CASDAC Level IV/V Functional Description.

#### APPROACH

A task group was formed to conduct a top-down study of CASDAC Level IV/V. This group consisted of members representing each Level IV/V functional system, with the HULDAC representative designated as task leader. Group meetings were held periodically to discuss the progress and direction of the study. At one of the early meetings, the group decided to be guided through the study by consensus decisions, as this appeared to offer the best method of arbitration.

The first group action was to identify objectives and determine a method for accomplishing those objectives. It was decided that a "top-down" approach would best produce the desired results.

The term "top-down" implies functionally decomposing the CASDAC Level IV/V system into progressively smaller understandable pieces, starting at the uppermost general level and working downward through the lower more detailed levels. There exist many different methodologies which would have been appropriate for this type study. After review of several of these methodologies, including Structured Analysis and Design Technique (SADT) and Meta Stepwise Refinement (MSR), the group decided to use Hierarchical Input-Process-Output (HIPO). (See Reference 3 for details of the HIPO system.) This decision was based on the relative simplicity of use of HIPO as compared to the other systems, with the corresponding incentive of reduced learning time.



The group jointly decided on the top-level functional structure to begin the study. This jointly developed portion of the HIPO model provided the necessary object to focus on some of the many problems which rapidly presented themselves. Figure 1 depicts the numbering scheme and structuring technique decided upon. Levels I, II and III are shown for organizational completeness and within Level IV, the management system functional system is not being addressed by this study. Additionally, it should be noted that the unlabeled boxes at Level IV are used to indicate that there may possibly be other functional system level subsystems which have not yet been identified. At this point it was also decided to modify the "pure" HIPO methodology by adding to the HIPO diagrams the "address information" to indicate the HIPO function from which each input originated, and the function to which each output was communicated. Figure 2 illustrates a typical HIPO diagram format.

Having established the basic guidelines for the development of the HIPO tree structure and diagrams, task group members responsible for each functional system proceeded to independently develop their system tree structures and diagrams.

First attempts at using the HIPO diagrams independently identified yet another problem. Complex systems can be modeled using many different criteria for decomposition. From this first effort, two distinct methods emerged. One approach established common functions at the upper level of the functional system and modeled subsets of these functions throughout the lower subsystem levels. The other method placed subsystems of the functional system at the upper level and modeled functions within each of these subsystems. These different approaches were decided to be inconsistent with the intent to provide a common standard for all of CASDAC Level IV/V. Use of the general functional breakdown forced the developer to make certain decisions pertaining to commonality of functions early in the process, while using the subsystem breakdown method meant repeating common functions in each subsystem. Models of distributive systems seemed to fit more easily into the generalized common function breakdown while developers of functional systems containing many differently configured subsystems had difficulty in identifying common functions at the upper level. After consideration of these and other factors, it was decided to attempt to construct the model using the generalized common function approach. This decision reflects the definition of the study as a general description of the top level of CASDAC Level IV/V.

Upon completion of the HIPO diagrams and tree structures (Appendix A), the model of each functional system was reviewed for vertical consistency, use of standard names, and organization of inputs and outputs. Following this independent review, the functional system representatives

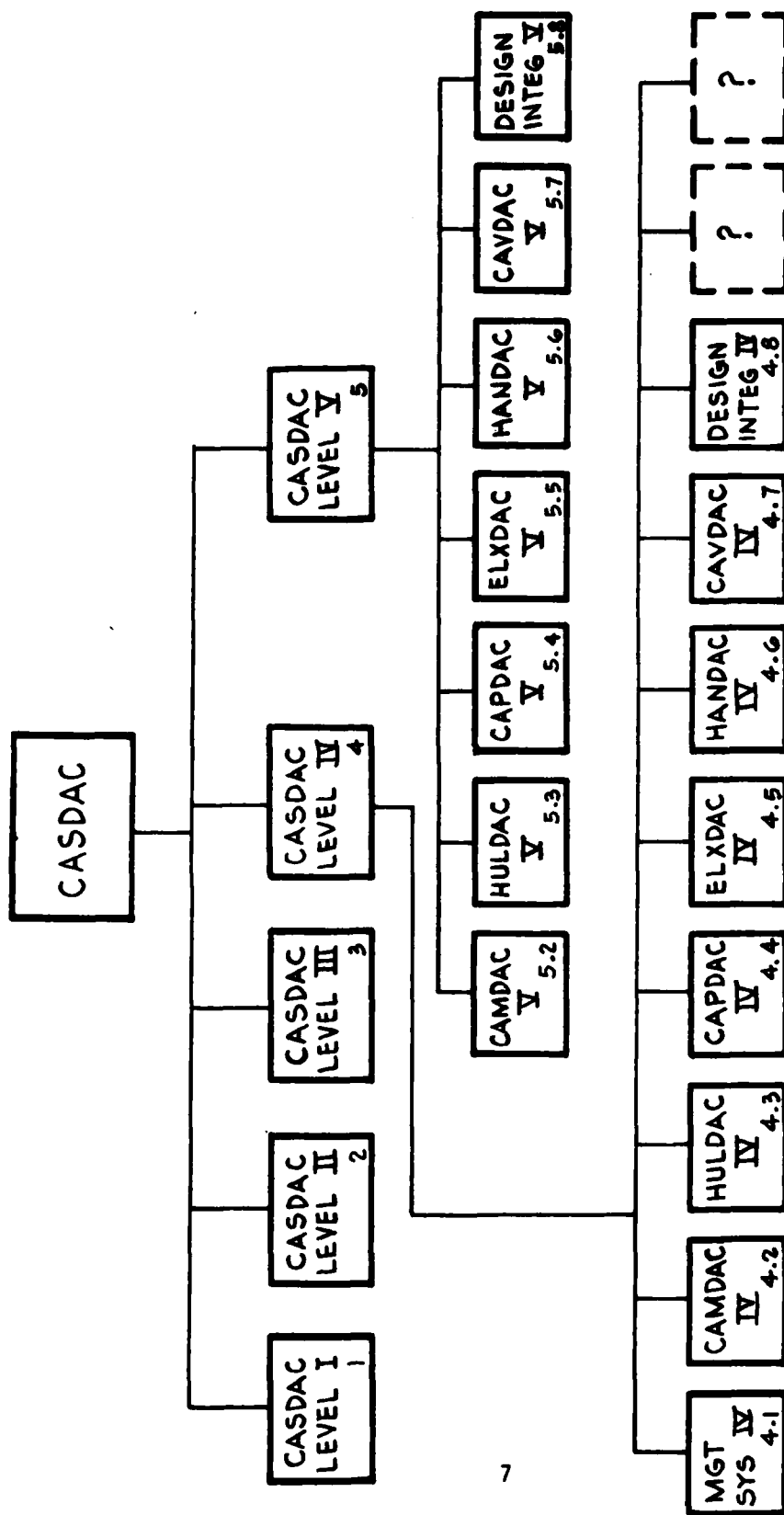


Figure 1 - Top Down Study Structure and Numbering Scheme

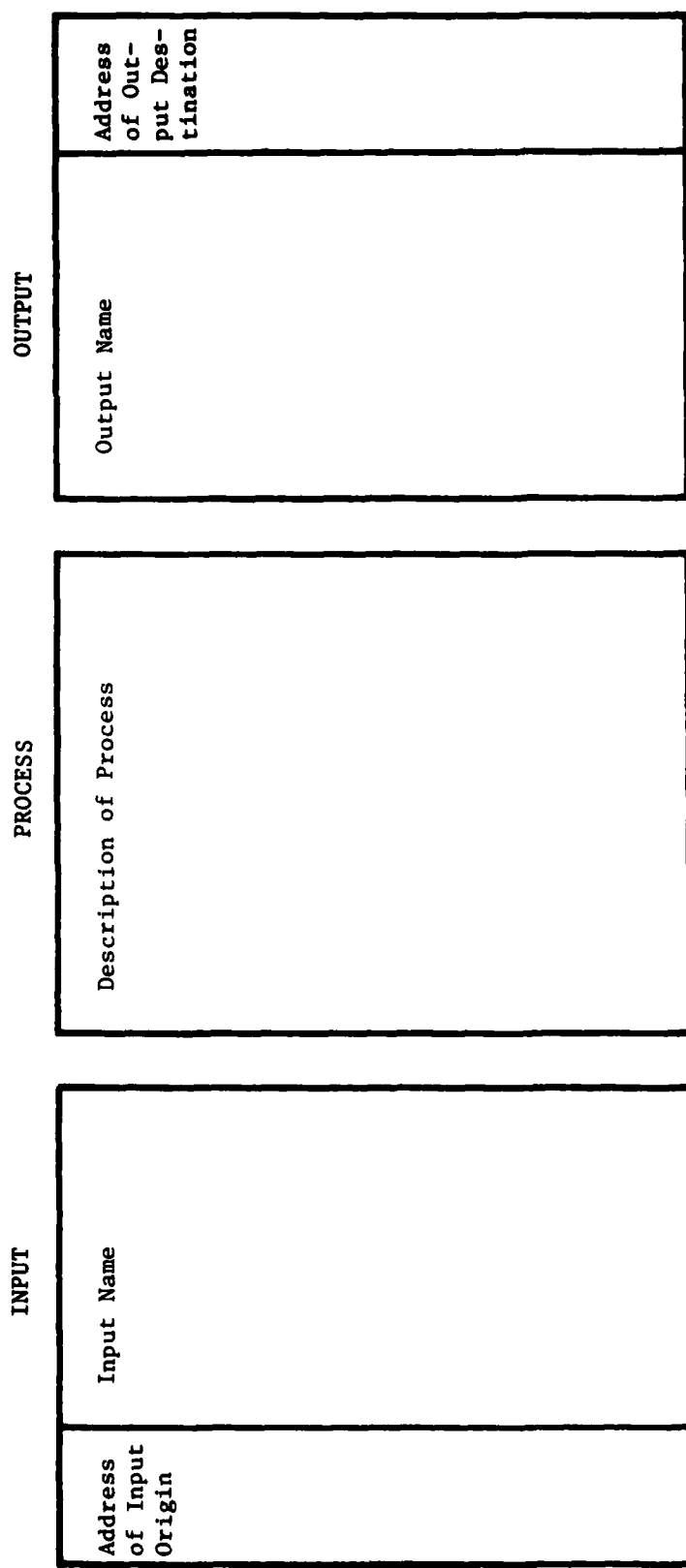


Figure 2 - Modified HIPO Diagram Format

paired off to compare and adjust the input/output interfaces between the various systems.

Concurrently with the development of the HIPO diagrams, copies of the Ship Work Breakdown System (SWBS) were marked up by cognizant task group members to establish the area of responsibility of each functional system in terms of SWBS elements "belonging" to each functional system. This SWBS mark-up was also intended to help ascertain the overall scope of CASDAC Level IV/V.

#### TASK PERFORMANCE

The performance of this task was principally the production and analysis of the data presented on the HIPO diagrams - Appendix A hereof. These diagrams give a description of the top-level functions of CASDAC Level IV/V. The systematic examination of these functions in terms of inputs required and outputs generated provided focus to the interfaces and helped to identify areas of common consideration. Even though the inputs and outputs are very general in nature and are identified in terms of lists, drawings, etc., in lieu of data elements, they provided the initial emphasis for the development of the findings and recommendations presented in the following sections.

## FINDINGS AND RECOMMENDATIONS

Findings and recommendations presented in this section will be ordered to match the objectives previously identified.

### SCOPE OF CASDAC LEVEL IV/V

One of the first questions raised by the top-down study team concerned the scope of the study as related to the scope of CASDAC IV/V. Although the stated objective was to define the scope of CASDAC Level IV/V, the team recognized that the study was limited in funds and agreed that a major point to be defined was how detailed the study would have to be to provide meaningful answers. It was determined that the scope of the study probably should not coincide identically with the scope of CASDAC Level IV/V, as the distinction between the two was not initially clear. It was felt that certain functions which fell within the domain of CASDAC Level IV/V need not be modeled in the study to obtain top level general answers.

Basic guidance for defining the scope of CASDAC IV/V is provided in the CASDAC Navy Decision Coordinating Paper (NDCP), Reference 4, and in some current in-house studies. However, a study of these documents failed to provide specific answers to many questions. The recognition that these questions related to the definition of several "boundaries" led to the development of the "circles of scope," Figures 3, 4, and 5.

Figure 3 represents the overall ship acquisition process, emphasizing the roles and interfaces among the Navy, shipbuilders, and vendors. There are certain fairly well-defined relationships and interactions between each of these participants, as indicated by the directional arrows crossing their boundaries. An example of these is at the Navy/Shipyard interface, where the Navy supplies the shipyard with the Contract Design Package, specifications, GFE, GFI, design approval, payment, etc.

Figure 4 builds on Figure 3 by adding solid heavy lines to indicate the portion of the ship acquisition process which is identified as the "domain" of responsibility of the CASDAC program. Figure 4 indicates that much of the area representing shipyard functions remains outside the domain of CASDAC Level IV/V, e.g., shipyard management and internal management information systems, personnel management, etc., together with activities associated with non-Navy tasks.

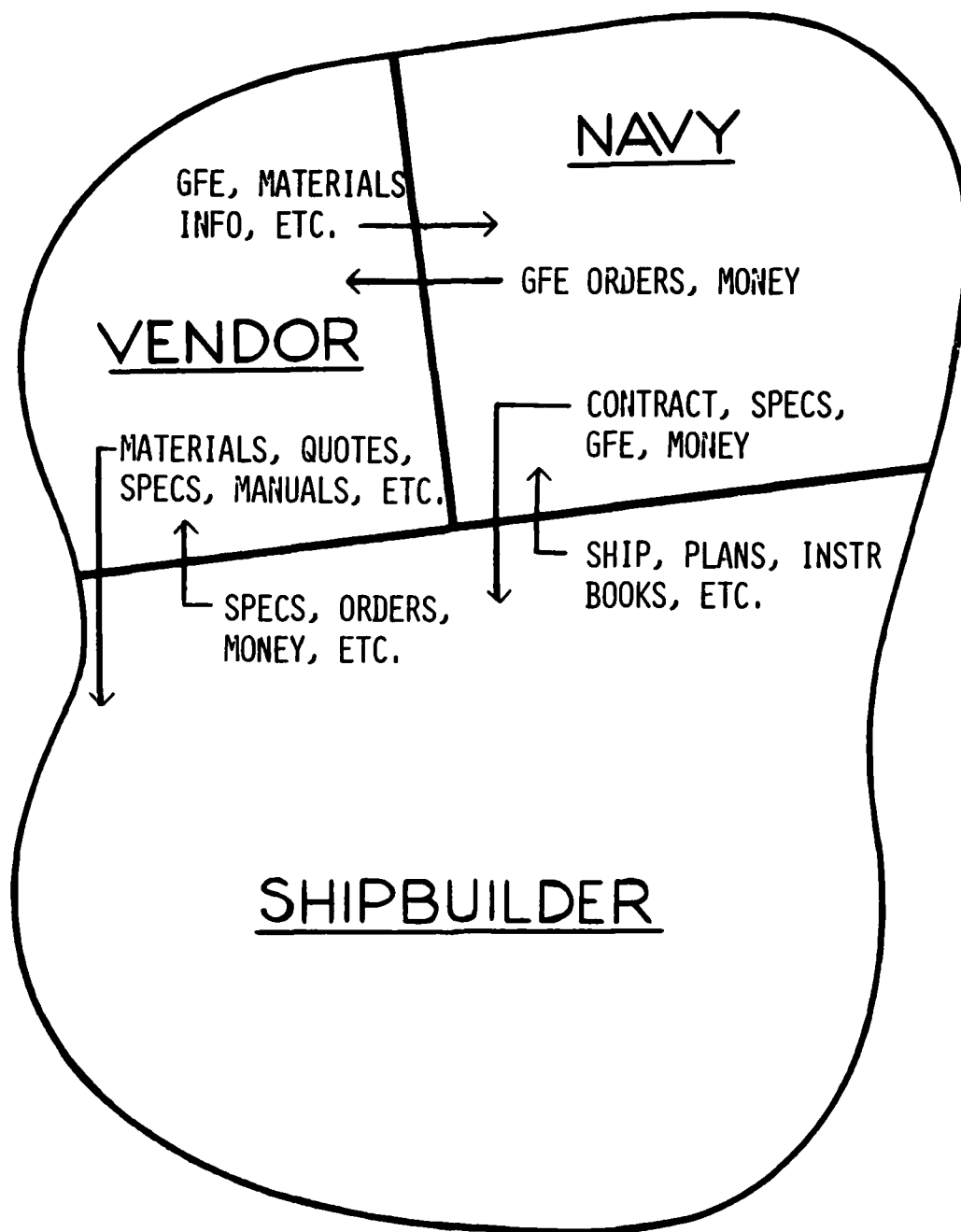


Figure 3 - Naval Ship Acquisition Process

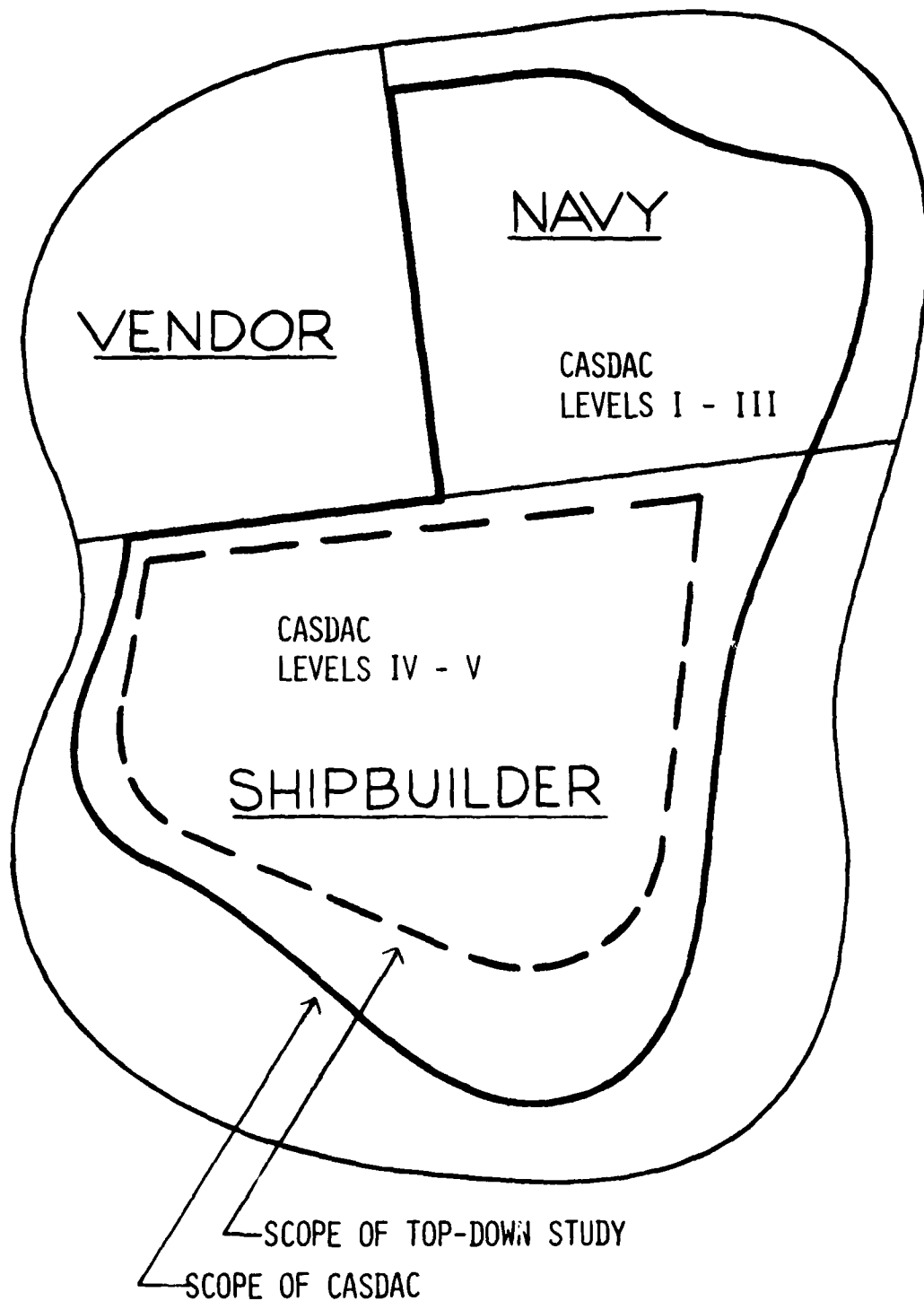


Figure 4 - CASDAC Domain

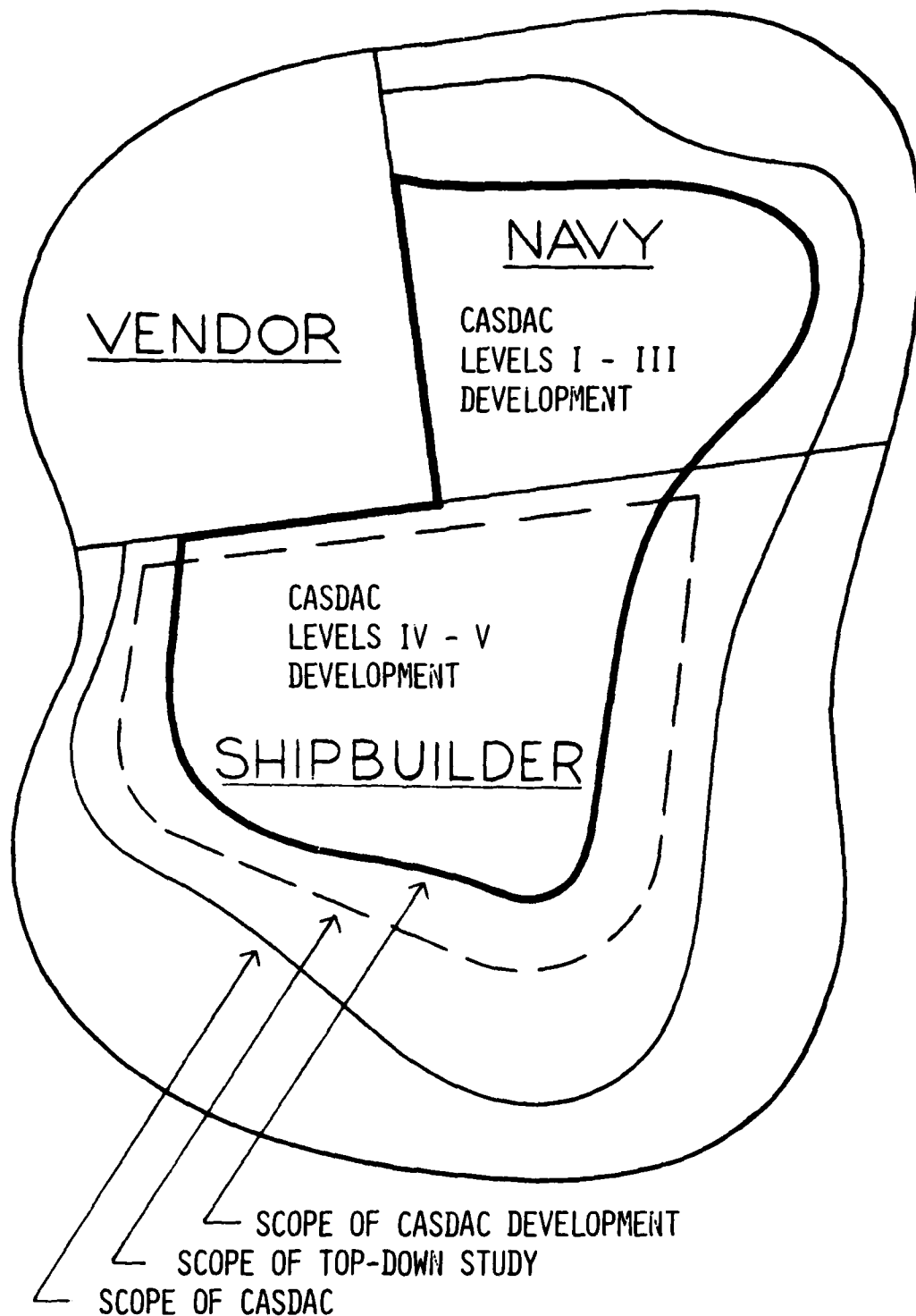


Figure 5 - CASDAC Software Development



Similarly, the CASDAC domain boundary takes in only part of the Navy's functions which include CASDAC Levels I - III currently under development by the Naval Ship Engineering Center. This recognizes that there is a continuing naval involvement in the ship acquisition process beyond contract design, and that many of these functions will remain outside the domain of CASDAC. Among the functions which will not be detailed in the model but may well be included, at least in part, in CASDAC, is the participation of the Supervisor of Shipbuilding (SOS) Office. The functions of this office are central to the continuing naval involvement and include contract administration, plan approval, cost negotiations, and change order management.

Also included in Figure 4 is an area enclosed by heavy dotted lines. This area represents the portion of CASDAC Level IV/V which is intended to be the subject of this study. This implies that there are shipyard functions which may well lie within the domain of CASDAC Level IV/V, but will not be addressed by this study. These are basically borderline management functions, material control and handling, scheduling, etc., which CASDAC may someday encompass, but which will not be examined in this study.

Finally, Figure 5 infers with the solid heavy lines that within the domain of the CASDAC system there is a subset of functions for which CASDAC will develop software.

Having thus identified and defined the "circles of scope," several original questions relating to scope were refined and became more pointed. Specific issues and problems relating to the scope of CASDAC Level IV/V are enumerated and discussed below.

Issue: Does CASDAC encompass ship repair and overhaul?

Recommendation: Ship repair and overhaul should be defined to be outside the domain of current CASDAC responsibility. However, CASDAC should:

- (1) Establish and maintain liaison with any computer-aided design developments aimed at repair/overhaul in order to avoid unwarranted duplication of effort.
- (2) Provide the mechanism whereby the final shipyard design data base representing the ship "as built"

will be preserved and retained by the Navy to support computer-aided design in subsequent repair/overhaul.

- (3) Identify these CASDAC modules which could be used in overhaul/repair, and develop the software to support the requirements of overhaul/repair, where these requirements may be accommodated with minor incremental effort.

Issue: Will CASDAC Level IV/V include naval activities beyond contract design?

Recommendation: Naval activities beyond Level III contract design should initially be considered outside the scope of CASDAC Level IV/V. However, future expansion of CASDAC should include those Supervisor of Shipbuilding functions previously discussed, and programs which address similar functions should be evaluated for current applicability.

Issue: What ship types will the CASDAC program address?

Recommendation: Investigation to date indicates that for the proposed funding of approximately \$40 million, it can be expected that CASDAC will basically be limited to mono-hull conventional-powered surface ships. Many of the programs developed in this vein will be usable for applications to other ship types.

In summary, the study recommends that the current scope of CASDAC Level IV/V should state that the initial version of CASDAC be limited to new ship design and construction of conventional-powered mono-hull surface vessels.

#### FUNCTIONAL SYSTEM RESPONSIBILITIES

It was decided by the top-down study team that one of the best ways to be certain of covering, or at least considering, all of the primary

tasks accomplished in Level IV/V would be to examine the Ship Work Breakdown Structure (SWBS), Reference 5, and to assign responsibility for each SWBS element to one or more of the functional systems.

Following the basic guidelines of the six functional system breakdowns, a SWBS matrix, Appendix C, was developed using the following guidance:

- For SWBS groups 1 - 7, representing physical pieces of the ship, each element was identified with one or more functional systems which hold responsibility for all or some portion of the ship pieces in that particular SWBS element.
- Elements in SWBS groups 8 and 9 represent shipyard activities and services, many of which should be considered in the top-down model, and many of which do not show use from analysis of groups 1 - 7. Where possible, the elements have been assigned to applicable functional systems in the matrix as with groups 1 - 7.
- SWBS group 0 represents activities and services performed by the Navy. Many of these are performed prior to letting the contract and are of little consequence to this top-down study, as they are effected through the Level III interface. Many group 9 activities, however, occur while and after the ship is being constructed, and are indicative of many functions during Levels IV and V. Group 0 elements are not correlated with functional systems, but should be reviewed when considering the continuing interface between the functional systems and the Navy throughout Levels IV and V.

The original intent of this SWBS matrix development was to help define the areas of responsibility for each of the functional systems. In developing the matrix it became apparent that issues relating to the overall scope of CASDAC, such as submarines, nuclear power, non-conventional hull forms, etc., had to have some kind of resolution in order to complete the matrix. Since resolution of those issues was not immediately forthcoming, they were avoided for expediency in developing

the matrix by assigning each SWBS element to the functional system or systems which would have responsibility if CASDAC were to be expanded to include all types of naval vessels.

Unresolved issues include:

Issue:                      Responsibility for Weapons

Recommendation: The SWBS matrix reflects major responsibility for weapons with the HULDAC functional system. This should change to reflect weapons systems belonging to ELXDAC with HULDAC assuming responsibility only for required structure and storage facilities.

#### DATA INTERFACES AMONG FUNCTIONAL SYSTEMS

A discussion of the development of the HIPO diagrams is included in a previous section. The individual HIPO diagrams served to highlight the exchange of information between the functional systems at a general level by identifying and addressing the various documents which are developed by the functional systems and which are needed to transmit data. It was recognized that the flow of data at the document level was not sufficient for the planning, development and administration of a Computer-Aided Design (CAD) system. Design communication in CAD systems is typically accomplished by using various "sets" of data down to the element level. At the level of detail addressed in the HIPO diagrams it was not feasible to identify data at the element level. However, this could be accomplished if the study were to be expanded to model individual program modules.

To help identify the interfaces between the functional systems, an input-output (I/O) matrix (Appendix D) was developed using information obtained from the HIPO diagrams. The exchange of information between functional systems is best illustrated by examining the HULDAC portion of the matrix. This interface between HULDAC and the other functional systems is perhaps the most common of all the interfaces as a result of the requirement of each functional system to have information on the physical description of the ship. This information includes hull form, compartmentation, and structural configuration. In addition, information concerning equipment foundations is supplied to HULDAC by each of the other functional systems. This is indicative of the fact that the majority of interface data between functional systems is of a physically descriptive nature. Much of the technical data is contained within each functional system and is passed between subsystems within the functional system depending on the various design stages.

### LEVEL III DATA INTERFACE WITH CASDAC IV/V

The CASDAC Level III/IV interface is presented by the upper level HIPO diagrams of the various functional systems. However, this interface is presented in very general terms, such as contract specifications, contract drawings, contract guidance plans, GFE/GFI, vendor data, etc. In general, these are all components of the Level III output, which is the interface, and which can be summarized as data necessary to insure that the ship design is sound and that the ship and ship systems will meet the required design characteristics. These data serve as the basis for the detail design development and have in the past been transmitted to the builder in the form of printed matter, such as specifications and drawings. In the CASDAC system, the form of the Level III output is not yet completely defined in terms of digital data/data base structure. It is envisioned that much of future Level III output will be in a digital form which can be immediately loaded into the shipyard data base for a particular ship. In addition, there are some current studies which are advocating moving much of the detail design process into Level III. While this concept appears very interesting, it has not been addressed in this study. The fact that CASDAC Level III is currently under development and the form of specific data elements cannot yet be determined explains the use of general terms in the HIPO diagrams.

Several issues concerning the data interface between Levels III and IV remain in question, and it is the recommendation of this study that the resolution of those issues, including the identification of the interface data at the element level, should be included in the various functional descriptions of each functional system.

### COMMON SOFTWARE DEVELOPMENT

This objective is perhaps one of the most important outputs from this study. The desirability of finding areas of common software development is most obvious. Unfortunately, the level of detail of this study is very general and consequently most of the findings of the study are also very general. Several areas appear to offer themselves as candidates for common software development. These areas cover functions which are common to each functional system but which have not been investigated to a proper depth to ascertain positive commonality in all respects. Some of these are development of various lists, procurement specifications, graphics, planning functions, catalog development and maintenance, etc.

The single most promising of these areas is graphics. The development of drawings as the prime means of communications between the engineers/designers and the yard workers is certainly a common function shared

by each of the functional systems. Even though the format and content of the drawings may differ, the basic graphics principles remain the same.

Another area of common software development which has not been included in this study, but which should not be overlooked, is the use in Level IV of programs developed in Level III. Many of the programs developed in Level III may prove directly applicable in Level IV, while others may require update/modification to be useful.

Recommendation: Close liaison should be maintained with the developers of CASDAC Level III to ensure maximum consideration for use of Level III software in Level IV.

#### FUNCTIONAL SYSTEM TYPICAL DATA

Data identified in this study are in the form of documents. This reflects the general, high-level nature of the study. The documents identified as input and output for the various functional systems have been organized into a hierarchical type listing (Appendix E) for each functional system. These input/output document lists were developed from the HIPO diagrams. An identification number was assigned to each input and output within each functional system. These identification numbers include designation of the functional system, separation of input and output, and data organization. For example, the number D.MI.1 would break down as follows:

D = Document

MI = Machinery Input

1 = Contract Data

D.MI.1.1 would include the first level breakdown of contract data. In this example, the final ".1" means detail specifications.

The schema becomes confusing in the case of interface data, since the same data item is listed as output from one functional system, carrying that functional system's identification, while at the same time being listed as input to at least one other functional system and, as such, carrying a new identification. This situation resulted from the fact that each functional system representative recognized the need for identifying and organizing data but that all of them agreed that time would not permit development of a consolidated list.

In developing the HULDAC listing, there emerged a clear subdivision of Level IV into system level engineering and detail design. The system level engineering is a redo/certification of the NAVSEC design which is preliminary to, and provides input for, the detail design phase. This pattern of preliminary engineering followed by detail design appears to be prevalent throughout the functional systems, although it is not explicitly recognized in the other subsystems, as it is in HULDAC.

Issue: Data List by Functional System

Recommendation: Development of a consolidated data list/data dictionary for all of CASDAC Level IV/V is imperative. This study has dealt with data in the form of documents. This was due to the high-level general nature of the study. It is recommended that future functional system detailed model development include the data modeled to a comparable level of detail, and labeled and included in a CASDAC data dictionary.

Issue: Engineering/Detail Design Functional Separation

Recommendation: Developers of Level IV/V functional systems should closely examine subject functional models for common trends such as a separation of the engineering and detail design functions. The understanding of any such trends may possibly determine major subsystem breakdown of proposed functional systems.

#### LEVEL IV/V INTERFACE

This study did not examine CASDAC Level V, as time and funds would not permit. However, the study has raised some interesting points and questions regarding CASDAC Level V. The most central of these questions concerns whether or not there is a distinct line between Level IV and Level V and exactly where this line falls.

The current trend seems to be leading toward production of assembly drawing work packages, which are a combination of design and production capabilities. More and more the design and production stages are

approaching and overlapping each other and this may well be the foundation for a happy marriage.

Issue: Should production planning/scheduling and material control-type functions be included in CASDAC?

Recommendation: The current development model of CASDAC Level IV/V should not include production scheduling and material control type functions. However, these type functions should be considered in any expanded version of CASDAC.

#### CASDAC IV/V FUNCTIONAL DESCRIPTION INPUTS

It was anticipated that this study would produce input for several sections of the CASDAC Level IV/V functional description. The sections envisioned to be substantially extracted from this top-down study are as follows:

1. Project References
2. Background
3. Objectives
4. Existing Methods and Procedures
5. Specific Performance Requirements
6. System Function
7. Inputs/Outputs
8. Interfaces

Developers of the CASDAC Level IV/V functional description will find scattered input in various sections of this study. However, the extent of these inputs is generally less than originally hoped for.

The top-down study, in modeling the system functions, made the assumption that at the top level there would be no significant differences due to manual/automatic functions. There are certain functions which do not show up in a model of the manual system, but which are germane to the development of an automatic system. These functions deal primarily with data descriptions and data handling. However, the basic premise of the assumption remains true, due mainly to the high level general nature of the study, and, consequently, the model more closely depicts the manual process.



**Recommendation:** A model should be developed which would represent the functions in a proposed computer-aided design system.

## DESIGN INTEGRATION

The top-level HIPO diagram indicates that there may be functional system level functions in addition to the six previously defined functional systems. One such candidate system is design integration. The single HIPO diagram developed for this design integration function can be explained by the fact that while this function is certainly performed by all functional systems, there are several different approaches to its accomplishment, and many different levels within it.

In many cases, design integration is accomplished by an independent group or committee consisting of members representing the various shipyard design activities. This group accomplishes interferences checks and maintains liaison between functional systems by preparing composite drawings or overlay drawings showing the physical location of the individual functional system equipment or structure. In other cases, this interdisciplinary liaison is conducted by the individual responsible for the arrangement of a particular space. The individual must gather all relevant information currently available concerning the subject space and conduct interference checks with other disciplines as deemed necessary.

If a digital description of the ship and ship systems existed either in a common data base or in separate data bases sharing a common access mechanism, an engineer/designer would have access through this central repository to all/any current information relevant to a particular space. This feature of a central source data search could improve the interference checking capability tremendously. The capability could be easily expanded to provide graphic representation of the existing data, which would aid the responsible engineers further by allowing visual interference checks. In addition, a properly designed and managed data base could provide the foundation for sophisticated programs which could automatically conduct interference checks and flag error conditions.

**Issue:** Should there be a seventh functional functional system for Design Integration?

**Recommendation:** Due to the lack of sufficient information about the particulars of this design integration function, it is

recommended that at this time design integration should remain under the cognizance of the individual functional systems. However, as models of the individual functional systems become more detailed it is expected that more firm direction concerning the establishing of additional functional systems should emerge.

#### EVALUATION OF HIPO USAGE

The selection of HIPO as the primary tool for the conduct of this study has been previously explained as basically one of economic expediency. However, HIPO may well have been selected if the economic factor had been dismissed from consideration.

It was observed immediately that the HIPO diagrams needed to include address information for inputs and outputs. This was the major deviation from the recommended HIPO diagram usage.

The one major disadvantage noted in using HIPO was that the HIPO method presents a picture of a system in a large number of very small "windows." A user sees one function per window and tends to lose sight of how that function fits in and reacts with the other functions. This leads to much page-flipping and loss of appreciation for data flow. In comparison, the SOFTECH SADT method presents one "generation" of functional hierarchy, consisting of perhaps five functions, on a single page. The SADT diagrams therefore appear more complex, as indeed they are, but this complexity is the illustration of the inter-functional relationships which the HIPO user must mentally build for himself and retain in his head.

Recommendation: If the top-down model is extended to depict greater functional detail, and is to be used as the basic process model about which CASDAC will be developed, the SADT method should be used in preference to the HIPO method.

## SUMMARY

This top-down study has provided a framework for defining the scope of CASDAC, has identified policy issues related to the scope which deserve to be resolved, and has recommended policy to clarify some. CASDAC top management should ratify or modify recommended policy and reflect decisions in appropriate CASDAC documentation.

This study has resolved responsibilities of functional systems and provided a top-level model for continued development of process and data models in each functional system.

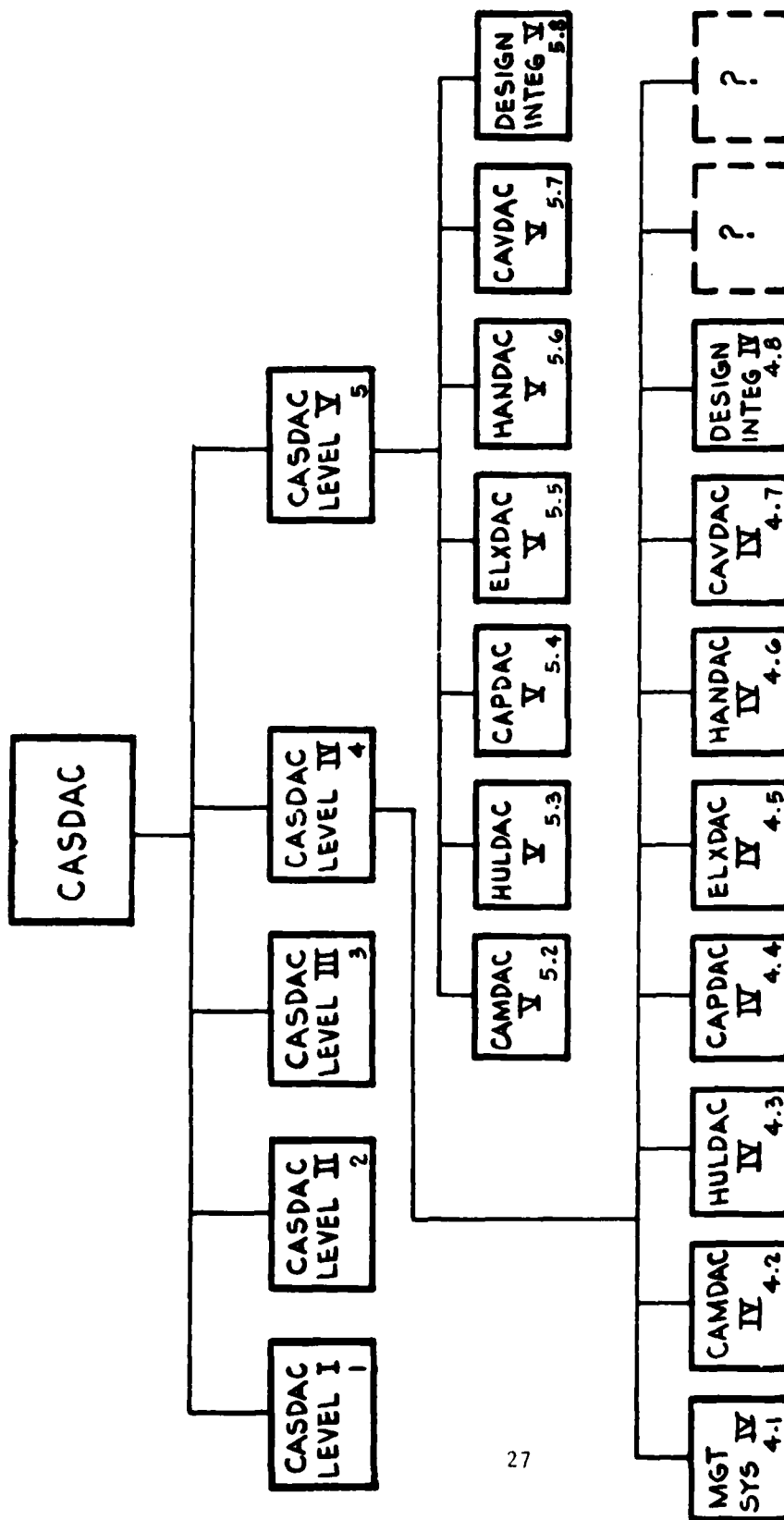
As a side benefit, the study has provided common modeling experience to each participant, and hopefully each functional system developer will remember the lessons of this model and proceed to develop individual functional systems using similar modeling tools.

#### REFERENCES

1. Sheridan, H. et al., "Engineering Analysis of the Piping Process for Naval Ship Design, Planning and Construction," David W. Taylor Naval Ship Research and Development Center, DTNSRDC Report CMD-7-75 (June 1975).
2. Computer-Aided Ship Design and Construction (CASDAC) Electrical/Electronic Detail Design Networks Report, Naval Ship Engineering Center, NAVSEC 6105-189-8462 (October 1977).
3. Jones, M., "HIPO for Developing Specifications," Datamation, Vol. 23, No. 3, page 110 (1976).
4. Office of the Chief of Naval Operations, Computer-Aided Ship Design and Construction (CASDAC) Navy Decision Coordinating Paper, NDCP #S-0381-SL, Approved 21 April 1978.
5. "Ship Work Breakdown Structure," Naval Sea Systems Command, NAVSEA Report 0900-LP-039-9010 (August 1977).

APPENDIX A

HIPO TREES AND DIAGRAMS



## Top Down Study Structure

CASDAC LEVEL IV

TOP LEVEL

HIPO

DIAGRAM

FROM: CASDAC

INPUT

PROCESS

OUTPUT

|         |   |  |   |
|---------|---|--|---|
| LVL III | <p>D.1 BID AND CONTRACT DATA</p> <p>D.2 STANDARDS AND QA PROCEDURES</p> <p>D.3 SCHEDULES</p> <p>D.4 PRODUCTION PLANS</p> <p>D.8 EQUIPMENT AND MATERIAL CONTROL DATA</p> <p>D.9 RESOURCES DATA</p> | <p>CASDAC LEVEL IV</p> <p>PROVIDE SYS ENG DET DES/DWGS</p> <p>INTERPRET SPECS AND REQUIREMENTS</p> <p>DRAW</p> <p>WRITE</p> <p>CALCULATE</p> <p>REDESIGN</p> | <p>D.2 STANDARDS AND QA PROCEDURES</p> <p>D.3 SCHEDULES</p> <p>D.5 ENGINEERING DOCUMENTATION</p> <p>D.6 DETAIL DESIGN DOCUMENTATION</p> <p>D.8 EQUIPMENT AND MATERIAL CONTROL</p> |
|---------|---|--|---|

TO: 4.1 THROUGH 4.8

BOX: 4

TITLE: CASDAC LEVEL IV



MANAGEMENT SYSTEMS 4.1

HIPO

DIAGRAM

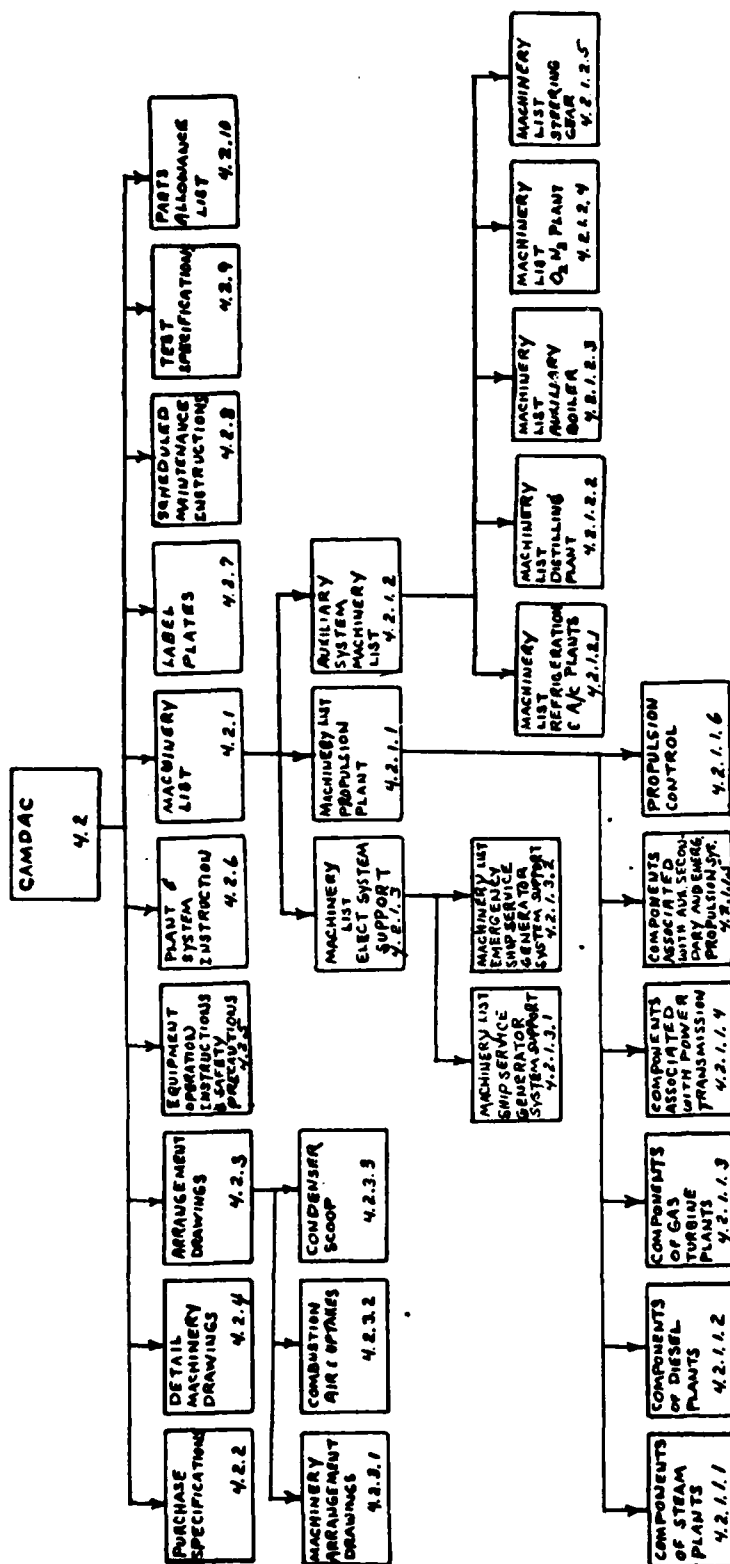
NOTE: No HIPO diagrams were  
developed for this section.

CAMDAC 4.2

HIPO

DIAGRAMS

FROM: CASDAC LEVEL IV



TITLE: CAMDAC STRUCTURE

FROM: 4 CASDAC LEVEL IV

| INPUT |                              | PROCESS                           | OUTPUT                                       |
|-------|------------------------------|-----------------------------------|--|
| 3     | CONTRACT SPECS               | 1. REVIEW CONTRACT SPECIFICATIONS | MACHINERY LIST<br>E.3.1                      |
| 3     | CONTRACT & GUIDANCE DRAWINGS | 2. PREPARE                        | PURCHASE SPECIFICATIONS<br>E.3<br>5.2<br>4.3 |
| E.2   | VENDOR'S DATA                | • DRAWINGS                        | DRAWINGS<br>4.4<br>4.5                       |
| 4.1   | PLAN SCHEDULE                | • LISTS                           | INSTRUCTIONS<br>4.6<br>4.7                   |
| 4.3   | C & A                        | • PURCHASE SPECIFICATIONS         |  |
| 4.3   | STRUCTURE                    | • INSTRUCTIONS                    |  |
| 4.7   | HVAC INTERFACE DATA          |                                   |  |
| 4.5   | CABLEWAYS DEGAUSSING COILS   |                                   |  |
| 4.4   | PIPING DIAGRAMMATICS         |                                   |  |

TO: 4.2.1 THROUGH 4.2.10

BOX: 4.2

TITLE: CAMDAC

FROM: 4.2 CAMDAC

| INPUT   | PROCESS   | OUTPUT   |
|---|---|--|
| <div>3</div> <div>CONTRACT SPECS</div> <div>3</div> <div>CONTRACT &amp; GUIDANCE<br/>DRAWINGS</div> | <div>1. COMPUTE SIZE, RATINGS &amp;<br/>QUANTITIES FOR FOLLOWING<br/>CATEGORIES:</div> <ul style="list-style-type: none"> <li>• PROPULSION PLANT</li> <li>• AUXILIARY SYSTEMS</li> <li>• ELECTRICAL SYSTEMS<br/>REQUIRING MACHINERY<br/>SUPPORT</li> </ul> <div>2. ANALYZE PLANT OR SYSTEM<br/>&amp; SCOPE OUT OPERATING<br/>PARAMETERS</div> | <div>MACHINERY LIST</div> <div>4.2.3</div> <div>4.2.6</div> <div>INTERFACE DATA</div> <div>4.3</div> <div>4.4.1</div> <div>4.5</div> <div>4.7.3</div> <div>PROCUREMENT DATA</div> <div>4.2.2</div> |

TO: 4.2.1.1, 4.2.1.2 & 4.2.1.3

BOX: 4.2.1

TITLE: MACHINERY LIST

FROM: 4.2.1 MACHINERY LIST

| INPUT |                                 | PROCESS   | OUTPUT           |   |
|-------|---------------------------------|---|------------------|---|
| 3     | CONTRACT SPECS                  | 1. COMPUTE SIZE, RATINGS &<br>QUANTITIES FOR FOLLOWING<br>PROPULSION ELEMENTS:<br><ul style="list-style-type: none"> <li>• COMPONENTS OF STEAM PLANT</li> <li>• COMPONENTS OF DIESEL PLANT</li> <li>• COMPONENTS OF GAS TUR-<br/>                         BINE PLANT</li> <li>• POWER TRANSMISSION &amp;<br/>                         PROPULSOR COMPONENTS</li> <li>• COMPONENTS ASSOCIATED<br/>                         WITH AUXILIARY, SECON-<br/>                         DARY AND EMERGENCY PRO-<br/>                         PULSION SYSTEM</li> <li>• PROPULSION CONTROL<br/>                         COMPONENTS</li> </ul> | MACHINERY LIST   | 4.2.3<br>4.2.9  |
| 3     | CONTRACT & GUIDANCE<br>DRAWINGS |   | INTERFACE DATA   | 4.3<br>4.4.1<br>4.5<br>4.7.3.1<br>4.2.6<br>4.2.7<br>4.2.8 |
|       |                                 |   | PROCUREMENT DATA | 4.2.2   |

TO: 4.2.1.1.1 THROUGH 4.2.1.1.6

BOX: 4.2.1.1

TITLE: PROPULSION PLANT MACHINERY LIST

FROM: 4.2.1.1 PROPULSION PLANT MACHINERY LIST

OUTPUT

|                  |  |
|------------------|--|
| MACHINERY LIST   | 4.2.3  |
| INTERFACE DATA   | 4.2.1.1.4<br>4.2.1.1.6<br>4.2.3<br>4.2.6<br>4.2.7<br>4.4.1<br>4.5<br>4.7.3.1 |
| PROCUREMENT DATA | 4.2.2  |

PROCESS

|  |
|--|
| 1. PERFORM HEAT BALANCE & ESTABLISH PLANT OPERATING REQUIREMENTS   |
| 2. ANALYZE COMPONENTS IN THE STEAM CYCLE & DETERMINE OPERATING REQUIREMENTS  |
| 3. IDENTIFY & ESTABLISH ALL INTERFACE REQUIREMENTS (E.G., MOTORS, GLAND SEAL STEAM, LUBE OIL, COOLING WATER, ETC.) |

INPUT

|           |                              |
|-----------|------------------------------|
| 3         | CONTRACT SPECS               |
| 3         | CONTRACT & GUIDANCE DRAWINGS |
| 4.2.1.1.6 | PROPULSION CONTROLS          |

TO: NONE

BOX: 4.2.1.1.1

TITLE: MACHINERY LIST FOR STEAM PROPULSION PLANT

FROM: 4.2.1.1 PROPULSION PLANT MACHINERY LIST

INPUT

PROCESS

OUTPUT

|           |                                 |   |                  |  |
|-----------|---------------------------------|---|------------------|--|
| 3         | CONTRACT SPECS                  | 1. PERFORM ANALYSIS OF PRO-<br>PULSION PLANT TO DETERMINE<br>THE SIZE, RATING AND<br>QUANTITY OF COMPONENTS<br>& SYSTEMS REQUIRED IN A<br>DIESEL PLANT (E.G.,<br>STARTING AIR, FUEL OIL,<br>LUBE OIL, ETC.) | MACHINERY LIST   | 4.2.3  |
| 3         | CONTRACT & GUIDANCE<br>DRAWINGS |   | INTERFACE DATA   | 4.2.1.1.4<br>4.2.1.1.6<br>4.2.3<br>4.2.6<br>4.2.7<br>4.4.1<br>4.5<br>4.7.3.1 |
| 4.2.1.1.6 | PROPULSION CONTROLS             |   | PROCUREMENT DATA | 4.2.2  |

TO: NONE

BOX: 4.2.1.1.2

TITLE: MACHINERY LIST FOR DIESEL PROPULSION PLANT



FROM: 4.2.1.1.1 PROPULSION PLANT MACHINERY LIST

INPUT

|           |                                 |
|-----------|---------------------------------|
| 3         | CONTRACT SPECS                  |
| 3         | CONTRACT & GUIDANCE<br>DRAWINGS |
| 4.2.1.1.6 | PROPULSION CONTROLS             |

PROCESS

|    |  |
|----|--|
| 1. | PERFORM ANALYSIS OF PRO-<br>PULSION PLANT TO DETERMINE<br>THE SIZE, RATING AND<br>QUANTITY OF COMPONENTS<br>& SYSTEMS REQUIRED IN A<br>GAS TURBINE PLANT |
|----|--|

OUTPUT

|                  |   |
|------------------|---|
| MACHINERY LIST   | 4.2.3   |
| INTERFACE DATA   | 4.2.1.1.4<br>4.2.1.1.6<br>4.2.3<br>4.2.5<br>4.2.6<br>4.2.7<br>4.4.1<br>4.5<br>4.7.3.1 |
| PROCUREMENT DATA | 4.2.2   |

TO: NONE

BOX: 4.2.1.1.3

TITLE: MACHINERY LIST FOR GAS TURBINE PROPULSION PLANT

FROM: 4.2.1.1 PROPULSION PLANT MACHINERY LIST

OUTPUT

PROCESS

INPUT

|           |                              |  |                  |           |
|-----------|------------------------------|--|------------------|-----------|
| 3         | CONTRACT SPECS               | 1. COMPUTE SIZE, RATINGS & QUANTITIES FOR FOLLOWING POWER TRANSMISSION COMPONENTS & THEIR ACCESSORIES: | MACHINERY LIST   | 4.2.3     |
| 3         | CONTRACT & GUIDANCE DRAWINGS | • ELECTRIC PROPULSION GENERATOR & MOTOR  | INTERFACE DATA   | 4.2.1.1.6 |
| 4.2.1.1.1 | INTERFACE DATA               | • REDUCTION GEAR   |                  | 4.2.3     |
| 4.2.1.1.2 | (POWER, RPM, ORIENTATION)    | • CLUTCH & COUPLING  |                  | 4.2.5     |
| 4.2.1.1.3 | PROPULSION CONTROL DATA      | • SHAFTING   |                  | 4.2.7     |
| 4.2.1.1.6 |                              | • BEARINGS   |                  | 4.3.1.4   |
|           |                              | • PROPELLER  |                  | 4.5       |
|           |                              | 2. PERFORM VIBRATION, DYNAMIC SHOCK, STRESS & ALIGNMENT AS REQUIRED                                    | PROCUREMENT DATA | 4.6       |
|           |                              |  |                  | 4.7.3.1   |
|           |                              |  |                  | 4.4.1     |
|           |                              |  |                  | 4.2.2     |

TO: NONE

BOX: 4.2.1.1.4

TITLE: MACHINERY LIST FOR POWER TRANSMISSION COMPONENTS

FROM: 4.2.1.1 PROPULSION PLANT MACHINERY LIST

OUTPUT

PROCESS

INPUT

|           |                                 |   |                  |  |
|-----------|---------------------------------|---|------------------|--|
| 3         | CONTRACT SPECS                  | 1. PERFORM ANALYSIS OF &<br>DETERMINE SIZE, RATING &<br>QUANTITY OF COMPONENTS &<br>SYSTEMS RELATING TO AUXIL-<br>IARY, SECONDARY & EMER-<br>GENCY PROPULSION SYSTEMS | MACHINERY LIST   | 4.2.3  |
| 3         | CONTRACT & GUIDANCE<br>DRAWINGS |   | INTERFACE DATA   | 4.2.1.1.6<br>4.2.3<br>4.2.7<br>4.3.1.4<br>4.5<br>4.6<br>4.4.1<br>4.7.3.1 |
| 4.2.1.1.6 | PROPULSION CONTROLS             |   | PROCUREMENT DATA | 4.2.2  |

TO: NONE

BOX: 4.2.1.1.5

TITLE: MACHINERY LIST FOR AUXILIARY, SECONDARY & EMERGENCY  
PROPULSION SYSTEMS

FROM: 4.2.1.1 PROPULSION PLANT MACHINERY LIST

PROCESS

INPUT

OUTPUT

|                                     |                                |  |                  |   |
|-------------------------------------|--------------------------------|--|------------------|---|
| 3                                   | CONTRACT SPECS                 | 1. REVIEW CONTRACT SPECIFICATIONS AND INTERFACE DATA REGARDING PROPULSION PLANT CONTROLS | MACHINERY LIST   | 4.2.3   |
| 3                                   | CONTRACT & GUIDANCE DRAWINGS   | 2. SCOPE OUT REQUIREMENTS  | INTERFACE DATA   | 4.2.1.1.1<br>4.2.1.1.2<br>4.2.1.1.3<br>4.2.1.1.4<br>4.2.1.1.5<br>4.2.3<br>4.2.4<br>4.2.6<br>4.2.7<br>4.4.1<br>4.5 |
| 4.2.1.1.1<br>4.2.1.1.2<br>4.2.1.1.3 | INTERFACE DATA                 |  |                  |   |
| 4.2.3.1                             | MACHINERY ARRANGEMENT DRAWINGS |  | PROCUREMENT DATA | 4.2.2<br>4.7.3.1  |

TO: NONE

BOX: 4.2.1.1.6

TITLE: PROPULSION CONTROL

FROM: 4.2.1 MACHINERY LIST

| INPUT |                                 | PROCESS   | OUTPUT           |  |
|-------|---------------------------------|---|------------------|--|
| 3     | CONTRACT SPECS                  | 1. COMPUTE SIZE, RATINGS &<br>QUANTITIES OF ELEMENTS FOR<br>FOLLOWING AUXILIARY<br>SYSTEMS:<br>• REFRIGERATION & A/C<br>PLANTS<br>• DISTILLING PLANT<br>• AUXILIARY BOILER<br>• O <sub>2</sub> N <sub>2</sub> PLANT<br>• STEERING GEAR<br>2. IDENTIFY ALL INTER-<br>FACE REQUIREMENTS | MACHINERY LIST   | 4.2.3<br>4.2.9                                     |
| 3     | CONTRACT & GUIDANCE<br>DRAWINGS |   | INTERFACE DATA   | 4.4.1<br>4.5<br>4.7.3.1<br>4.2.6<br>4.2.7<br>4.2.8 |
|       |                                 |   | PROCUREMENT DATA | 4.2.2  |

TO: 4.2.1.2.1 THROUGH 4.2.1.2.5

BOX: 4.2.1.2

TITLE: AUXILIARY SYSTEMS MACHINERY LIST

FROM: 4.2.1.1.2 AUXILIARY SYSTEMS MACHINERY LIST

PROCESS

INPUT

|         |                                 |                  |  |
|---------|---------------------------------|------------------|--|
| 3       | CONTRACT SPECS                  | MACHINERY LIST   | 4.2.3  |
| 3       | CONTRACT & GUIDANCE<br>DRAWINGS | INTERFACE DATA   | 4.2.3<br>4.2.4<br>4.2.6<br>4.2.7<br>4.7.3.1<br>4.4.1<br>4.7.1.2<br>4.5 |
| 4.3.1.2 | C & A                           |                  |  |
| 4.7.3   | HVAC REVIEW                     | PROCUREMENT DATA | 4.2.2  |

TO: NONE

BOX: 4.2.1.2.1

TITLE: MACHINERY LIST FOR REFRIGERATION & A/C PLANTS

FROM: 4.2.1.2 AUXILIARY SYSTEMS MACHINERY LIST

| INPUT |                                 | PROCESS   | OUTPUT  |
|-------|---------------------------------|---|---|
| 3     | CONTRACT SPECS                  | 1. COMPUTE SIZE, RATING &<br>QUANTITY OF COMPONENTS<br>ASSOCIATED WITH DIS-<br>TILLING PLANT<br><br>2. ANALYZE SPECIFICATIONS<br>AND PREPARE SYSTEM<br>PARAMETERS | MACHINERY LIST<br>4.2.3   |
| 3     | CONTRACT & GUIDANCE<br>DRAWINGS |   | INTERFACE DATA<br>4.2.3<br>4.2.4<br>4.2.6<br>4.2.7<br>4.4.1<br>4.7.3.1<br>4.5 |
|       |                                 |   | PROCUREMENT DATA<br>4.2.2   |

TO: NONE

BOX: 4.2.1.2.2

TITLE: MACHINERY LIST FOR DISTILLING PLANT

FROM: 4.2.1.2 AUXILIARY SYSTEMS MACHINERY LIST

OUTPUT

|                                    |   |
|------------------------------------|---|
| AUXILIARY BOILER<br>MACHINERY LIST | 4.2.3   |
| INTERFACE DATA                     | 4.2.3<br>4.2.4<br>4.2.6<br>4.2.7<br>4.5<br>4.4.1<br>4.7.3 |
| PROCUREMENT DATA                   | 4.2.2   |

PROCESS

|   |
|---|
| 1. COMPUTE SIZE, RATING &<br>QUANTITY OF COMPONENTS<br>ASSOCIATED WITH<br>AUXILIARY BOILERS |
| 2. ANALYZE SPECIFICATIONS<br>AND PREPARE SYSTEM<br>PARAMETERS                               |

INPUT

|                        |                                 |
|------------------------|---------------------------------|
| 3                      | CONTRACT SPECS                  |
| 3                      | CONTRACT & GUIDANCE<br>DRAWINGS |
| 4.2.1.1.2<br>4.2.1.1.3 | WASTE HEAT DATA                 |

TO: NONE

BOX: 4.2.1.2.3

TITLE: MACHINERY LIST FOR AUXILIARY BOILERS



FROM: 4.2.1.2 AUXILIARY SYSTEMS MACHINERY LIST

| INPUT |                                 | PROCESS   | OUTPUT                  |   |
|-------|---------------------------------|---|-------------------------|---|
| 3     | CONTRACT SPECS                  | 1. COMPUTE SIZE, RATING &<br>QUANTITY OF COMPONENTS<br>ASSOCIATED WITH<br>$O_2N_2$ PLANT<br><br>2. ANALYZE SPECIFICATIONS<br>AND PREPARE SYSTEM<br>PARAMETERS | $O_2N_2$ MACHINERY LIST | 4.2.3   |
| 3     | CONTRACT & GUIDANCE<br>DRAWINGS |   | INTERFACE DATA          | 4.2.3<br>4.2.4<br>4.2.6<br>4.2.7<br>4.4.1<br>4.7.3.1<br>4.5 |
|       |                                 |   | PROCUREMENT DATA        | 4.2.2   |

TO: NONE

BOX: 4.2.1.2.4

TITLE: MACHINERY LIST FOR  $O_2N_2$  PLANT

FROM: 4.2.1.2 AUXILIARY SYSTEMS MACHINERY LIST

INPUT PROCESS OUTPUT

|   |                                 |   |                                  |  |
|---|---------------------------------|---|----------------------------------|--|
| 3 | CONTRACT SPECS                  | 1. COMPUTE SIZE, RATING &<br>QUANTITY OF COMPONENTS<br>ASSOCIATED WITH STEERING<br>GEAR | STEERING GEAR                    | 4.2.3  |
| 3 | CONTRACT & GUIDANCE<br>DRAWINGS | 2. ANALYZE SPECIFICATIONS<br>AND PREPARE SYSTEM<br>PARAMETERS                           | MACHINERY LIST<br>INTERFACE DATA | 4.2.3<br>4.2.4<br>4.2.6<br>4.2.7<br>4.4.1<br>4.7.3.1 |
|   |                                 |   | PROCUREMENT DATA                 | 4.2.2  |

TO: NONE

BOX: 4.2.1.2.5

TITLE: MACHINERY LIST FOR STEERING GEAR

FROM: 4.2.1 MACHINERY LIST

| INPUT |                                 | PROCESS   | OUTPUT  |
|-------|---------------------------------|---|---------|
| 3     | CONTRACT SPECS                  | 1. COMPUTE SIZE, RATING &<br>QUANTITY FOR FOLLOWING<br>ELECTRICAL SYSTEMS REQUIR-<br>ING MACHINERY SUPPORT:<br>• SHIP SERVICE GENERATORS<br>• EMERGENCY SHIP SERVICE<br>GENERATORS<br>2. IDENTIFY ALL INTERFACE<br>REQUIREMENTS | 4.2.3   |
| 3     | CONTRACT & GUIDANCE<br>DRAWINGS |   | 4.2.9   |
|       |                                 |   | 4.2.4   |
|       |                                 |   | 4.2.6   |
|       |                                 |   | 4.2.7   |
|       |                                 |   | 4.4.1   |
|       |                                 |   | 4.5     |
|       |                                 |   | 4.7.3.1 |
|       |                                 |   | 4.2.6   |
|       |                                 |   | 4.2.7   |
|       |                                 |   | 4.2.8   |
|       |                                 |   | 4.2.2   |

TO: 4.2.1.3.1 AND 4.2.1.3.2

BOX: 4.2.1.3

TITLE: ELECTRICAL SYSTEMS SUPPORT - MACHINERY LIST

FROM: 4.2.1.3 ELECTRICAL SYSTEMS SUPPORT - MACHINERY LIST

| INPUT |                                 | PROCESS  | OUTPUT   |
|-------|---------------------------------|--|--|
| 3     | CONTRACT SPECS                  | 1. COMPUTE SIZE, RATING &<br>QUANTITY OF COMPONENTS<br>ASSOCIATED WITH THE<br>MACHINERY SUPPORT OF THE<br>SHIP SERVICE GENERATOR<br>SYSTEM<br><br>2. ANALYZE SPECIFICATION<br>AND PREPARE SYSTEM<br>PARAMETERS | SHIP SERVICE GENERATOR<br>MACHINERY LIST                             |
| 3     | CONTRACT & GUIDANCE<br>DRAWINGS |  | 4.2.3<br>4.2.3<br>4.2.4<br>4.2.6<br>4.2.7<br>4.4.1<br>4.5<br>4.7.3.1 |
|       |                                 |  | PROCUREMENT DATA<br>4.3.2  |

TO: NONE

BOX: 4.2.1.3.1

TITLE: MACHINERY LIST FOR SHIP SERVICE GENERATOR SYSTEM

FROM: 4.2.1.3 - ELECTRICAL SYSTEMS SUPPORT - MACHINERY LIST

| INPUT |                              | PROCESS  | OUTPUT   |
|-------|------------------------------|--|--|
| 3     | CONTRACT SPECS               | 1. COMPUTE SIZE, RATING & QUANTITY OF COMPONENTS ASSOCIATED WITH THE MACHINERY SUPPORT OF THE EMERGENCY SHIP SERVICE GENERATOR SYSTEM<br><br>2. ANALYZE SPECIFICATIONS AND PREPARE SYSTEM PARAMETERS | EMERGENCY SHIP SERVICE GENERATOR MACHINERY LIST<br>4.2.3   |
| 3     | CONTRACT & GUIDANCE DRAWINGS |  | INTERFACE DATA<br>4.2.3<br>4.2.4<br>4.2.6<br>4.2.7<br>4.4.1<br>4.5<br>4.7.3.1<br><br>PROCUREMENT DATA<br>4.3.2 |

TO: NONE

BOX: 4.2.1.3.2

TITLE: MACHINERY LIST FOR EMERGENCY SHIP SERVICE GENERATOR SYSTEM

FROM: 4.2 CAMDAC

INPUT

|         |                     |
|---------|---------------------|
| 3       | CONTRACT SPECS      |
| 4.2.1   | MACHINERY LIST      |
| 4.2.3.2 | SPECIAL PROCUREMENT |
| 4.2.3.3 | DATA                |
| 4.2.5   |                     |
| 4.2.6   |                     |
| 4.2.7   |                     |
| 4.2.4   |                     |

PROCESS

|                                    |
|------------------------------------|
| 1. PREPARE PURCHASE SPECIFICATIONS |
| 2. REVIEW BIDS                     |
| 3. REVIEW VENDOR'S DRAWINGS        |

OUTPUT

|                         |       |
|-------------------------|-------|
| PURCHASE SPECIFICATIONS | E.2.2 |
|-------------------------|-------|

TO: NONE

BOX: 4.2.2

TITLE: PURCHASE SPECIFICATIONS

FROM: 4.2 CANDAC

INPUT

|       |                                 |
|-------|---------------------------------|
| 3     | CONTRACT SPECS                  |
| 3     | CONTRACT & GUIDANCE<br>DRAWINGS |
| 4.2.1 | MACHINERY LISTS                 |
| E.2   | COMPONENT DRAWINGS              |
| 4.3   | C & A                           |
| 4.3   | STRUCTURE                       |
| 4.2.4 | DETAIL MACHINERY<br>DRAWINGS    |

PROCESS

|   |
|---|
| 1. PREPARE ARRANGEMENT DRAW-<br>INGS FOR THE FOLLOWING: |
| • MACHINERY SPACES                                      |
| • COMBUSTION AIR AND<br>UPTAKES                         |
| • CONDENSER SCOOP                                       |
| 2. PERFORM PRESSURE DROP<br>CALCULATIONS AS REQUIRED    |

OUTPUT

|  |
|--|
| ARRANGEMENT DRAWINGS   |
| 4.2.4<br>4.2.7<br>4.3<br>4.4<br>4.5<br>4.6<br>4.7.6<br>4.2.6 |

TO: 4.2.3.1, 4.2.3.2, 4.2.3.3

BOX: 4.2.3

TITLE: ARRANGEMENT DRAWINGS

FROM: 4.2.3 ARRANGEMENT DRAWINGS

OUTPUT

PROCESS

INPUT

|   |  |                                |  |
|---|--|--------------------------------|--|
| 3   | <p>CONTRACT &amp; GUIDANCE DRAWINGS</p> <ul style="list-style-type: none"> <li>• MAIN MACHY ARR</li> <li>• PUMP RM, AUX MACH, REFRIGERATION MACH, SHOP &amp; SHAFTING ARR</li> </ul> <p>CONTRACT SPECS</p> <p>MACHINERY LIST</p> <p>VENDOR'S DRAWINGS</p> <p>STRUCTURE</p> <p>MOLDED HULL FORM</p> <p>VENT DUCTS</p> <p>HVAC ARR DRAWINGS</p> <p>CABLEWAYS</p> <p>NOISE REDUCTION &amp; ACOUSTIC TREATMENT</p> <p>C &amp; A</p> <p>DECAUSSING COILS</p> <p>ARR OF ELECT EQ</p> <p>DETAIL MACHINERY DRAWINGS</p>                                      | MACHINERY ARRANGEMENT DRAWINGS | <p>4.2.3.2</p> <p>4.2.3.3</p> <p>4.2.4</p> <p>4.2.5</p> <p>4.2.6</p> <p>4.2.7</p> <p>4.2.8</p> <p>4.2.9</p> <p>4.2.1.1.6</p> <p>4.3.1.1</p> <p>4.3.1.2</p> <p>4.3.2.1</p> <p>4.3.1.3</p> <p>4.3.1.1</p> <p>4.3.2.2</p> <p>4.5</p> <p>4.7.6.1</p> <p>4.4.1</p> <p>4.4.4</p> <p>5.2</p> <p>E.3.1</p> |
| <p>3</p> <p>4.2.1</p> <p>E-2</p> <p>4.3.2.1</p> <p>4.3.1.1</p> <p>4.7.7.1</p> <p>4.7.6.1</p> <p>4.5</p> <p>4.3.2.4</p> <p>4.3.1.2</p> <p>4.5</p> <p>4.2.5</p> | <p>1. USING MOLDED OFFSETS, C &amp; A, STRUCTURE, VENTILATION &amp; ELECTRICAL DRAWINGS PREPARE SCALED BACKGROUND DRAWINGS</p> <p>2. USING CONTRACT GUIDANCE DRAWINGS, VENDOR'S DRAWINGS SUPERIMPOSED ON BACKGROUND DRAWINGS, PREPARE FINISHED ARRANGEMENT DRAWINGS</p> <p>3. ARRANGEMENT DRAWINGS ARE PREPARED FOR THE FOLLOWING SPACES:</p> <ul style="list-style-type: none"> <li>• MAIN, AUX &amp; REFRIGERATION MACHINERY</li> <li>• SHOPS</li> <li>• SHAFTING</li> <li>• STEERING GEAR ROOM</li> </ul> <p>4. PREPARE LIFTING GEAR DRAWINGS</p> |                                |  |

TO: NONE

BOX: 4.2.3.1

TITLE: MACHINERY ARRANGEMENT DRAWINGS



FROM: 4.2.3 ARRANGEMENT DRAWINGS

| INPUT   |  | PROCESS   | OUTPUT  |
|---------|--|---|---|
| 3       | CONTRACT SPECS   | 1. PREPARE COMBUSTION AIR & UPTAKE ARRANGEMENT DRAWINGS<br>2. PERFORM PRESSURE DROP CALCULATIONS TO ASSURE ADEQUACY OF BLOWERS<br>3. PREPARE BILL OF MATERIAL | COMBUSTION AIR & UPTAKE ARRANGEMENT DRAWINGS<br>B/M                             |
| 3       | CONTRACT & GUIDANCE DRAWINGS   |   |   |
|         | <ul style="list-style-type: none"> <li>• UPTAKES</li> <li>• MAIN MACHINERY ARR</li> <li>• GENERAL ARR</li> </ul> |   |   |
| E.2     | VENDOR'S DRAWINGS-BOILERS, FORCED DRAFT BLOWERS, TRASH BURNER, SMOKE INDICATORS                                  |   |   |
| 4.3.1.2 | C & A  |   |   |
| 4.3.2.1 | STRUCTURE  |   | 4.2.2<br>4.3.1.2<br>4.3.1.1<br>4.3.1.3<br>4.2.7<br>4.2.4<br>5.2<br>E.3.1<br>5.3 |
| 4.2.3.1 | MACHINERY ARRANGEMENT DRAWING  |   |   |

TO: NONE

BOX: 4.2.3.2

TITLE: COMBUSTION AIR AND UPTAKES

FROM: 4.2.3 ARRANGEMENT DRAWINGS

| INPUT   |                              | PROCESS   | OUTPUT  |
|---------|------------------------------|---|---|
| 3       | CONTRACT SPECS               | 1. PREPARE ARRANGEMENT DRAWING FOR MAIN CONDENSER SCOOP, CIRC PUMP INJECTION, OVERBOARD & LUB OIL COOLING WATER CIRCUIT<br><br>2. PERFORM CALCULATION FOR DEVELOPED HEAD & PRESSURE DROP TO ASSURE ADEQUACY OF MAIN CONDENSER COOLING CIRCUIT<br><br>3. PREPARE B/M | ARRANGEMENT DRAWING & B/M   |
| 3       | CONTRACT & GUIDANCE DRAWINGS |   |   |
| 4.2.3.1 | MACHINERY ARRGT DWG          |   |   |
| 4.3.2.1 | STRUCTURE                    |   |   |
| 4.3.1.1 | MOLDED HULL FORM             |   |   |
| E.2     | VENDOR'S DRAWINGS            |   | 4.2.2<br>4.3.1.1<br>4.3.1.3<br>4.2.4<br>4.2.7<br>4.2.5<br>5.2<br>5.3<br>E.3.1 |

TO: NONE

BOX: 4.2.3.3

TITLE: CONDENSER SCOOP

FROM: 4.2 CAMDAC

INPUT

|         |                                   |
|---------|-----------------------------------|
| 3       | CONTRACT SPECS                    |
| 4.2.3.1 | MACHINERY ARRANGEMENT<br>DRAWINGS |
| E.2     | VENDOR'S DRAWINGS                 |
| 4.4.1   | INTERFACE REQUIREMENTS            |
| 4.2.1   | MACHINERY LIST                    |
| 4.2.3.2 | COMBUSTION AIR & UP-<br>TAKES     |
| 4.2.3.3 | CONDENSER SCOOP                   |

PROCESS

|   |
|---|
| 1. PREPARE DETAIL MACHINERY<br>DRAWINGS AS REQUIRED   |
| 2. THE FOLLOWING ARE ITEMS<br>FOR WHICH DETAIL DRAWINGS<br>WOULD BE REQUIRED  |
| <ul style="list-style-type: none"> <li>• GAGE BOARDS</li> <li>• MISC. NON-STRUCTURAL<br/>TANKS</li> <li>• SAFETY VALVE EASING GEAR</li> <li>• TORCH POTS</li> <li>• DRIP PANS</li> <li>• BURNER CLEANING BENCH</li> <li>• MACHINERY INSULATION</li> </ul> |
| 3. PREPARE B/M  |

OUTPUT

|  |
|--|
| DETAIL DRAWING & B/M   |
| <ul style="list-style-type: none"> <li>5.2</li> <li>5.3</li> <li>4.2.3</li> <li>E.3.1</li> <li>4.2.5</li> <li>4.2.7</li> <li>4.2.9</li> <li>4.3.2.2</li> </ul> |

TO: NONE

BOX: 4.2.4

TITLE: DETAIL MACHINERY DRAWINGS

FROM: 4.2 CAMDAC

| INPUT |                                      | PROCESS  | OUTPUT |
|-------|--------------------------------------|--|--------|
| 3     | CONTRACT SPECS                       | 1. PREPARE TEXT FOR OPERATING INSTRUCTIONS, SAFETY PRECAUTIONS & WARNING PLATES<br>2. PREPARE SPECIFICATIONS FOR PROCURING OR MANUFACTURING PERMANENT HARD COPIES OF THESE INSTRUCTIONS & PRECAUTIONS<br>3. PREPARE INSTRUCTIONS DESIGNATING LOCATION OF HARD COPIES | 4.2.9  |
| E.2   | VENDOR'S COMPONENT TECHNICAL MANUALS |  | 4.2.6  |
| 4.4.1 | PIPING DIAGRAMMATIC DRAWINGS         |  | E.3.1  |
|       | BUREAU OF SHIPS TECHNICAL MANUAL     |  | E.3.2  |
| 4.2.3 | ARRANGEMENT DRAWINGS                 |  | 5.2    |
| 4.2.4 | DETAIL MACHINERY DRAWINGS            |  | E.3.1  |
|       |                                      |  | 5.2    |

TO: NONE

BOX: 4.2.5

TITLE: EQUIPMENT OPERATING INSTRUCTIONS AND SAFETY PRECAUTIONS

FROM: 4.2 CAMDAC

INPUT

PROCESS

OUTPUT

|         |                                      |   |   |       |
|---------|--------------------------------------|---|---|-------|
| 3       | CONTRACT SPECS                       | 1. PREPARE TEXT AND/OR DRAWINGS FOR FOLLOWING PLANT OR SYSTEM INSTRUCTION AIDS: | TEXT AND/OR DRAWING OF INSTRUCTION AIDS | 4.2.9 |
| E.2     | VENDOR'S DRAWING & TECHNICAL MANUALS | • CONTROL ORDER BOARDS  |   | E.3.1 |
| 4.4.1   | PIPING DIAGRAMMATICS                 | • ENGINEERING ORDER BOARDS  | PROCUREMENT OR MANUFACTURING SPECS      | 5.2   |
| 4.2.1.1 | COMPONENT & PLANT                    | • REPAIR PARTY DIAGRAMS   |   | E.3.1 |
| 4.2.1.2 | OPERATING DATA                       | • PROPULSION OPERATING GUIDES   |   | 4.2.4 |
| 4.2.1.3 |                                      | • PROPULSION PLANT DESCRIPTION & OPERATING MANUAL                               | MOUNTING INSTRUCTIONS                   | 5.2   |
| 4.2.3   | ARRANGEMENT DRAWINGS                 | • ENGINEERING CASUALTY CONTROL MANUAL   |   | E.3.1 |
| 4.2.5   | EQ OPERATING INSTR                   | • SHIP INFORMATION BOOKLETS   |   | 5.2   |
| 4.2.1   | MACHINERY LISTS                      | 2. PREPARE SPECS FOR PROCUREMENT OR MFG HARD COPIES                             |   |       |
|         |                                      | 3. PREPARE INSTRUCTIONS DESIGNATING LOCATION OF HARD COPIES REQUIRING MOUNTING  |   |       |

TO: NONE

BOX: 4.2.6

TITLE: PLANT & ENGINEERING SYSTEM INSTRUCTIONS

FROM: 4.2 CAMDAC

INPUT

|       |                                |
|-------|--------------------------------|
| 3     | CONTRACT SPECS                 |
| 4.2.1 | MACHINERY LIST                 |
| 4.2.3 | ARRANGEMENT DRAWINGS           |
| 4.2.4 | DETAIL ARRANGEMENT<br>DRAWINGS |

PROCESS

|   |
|---|
| 1. PREPARE TEXT FOR INDIVID-<br>UAL COMPONENT LABEL PLATE |
| 2. PREPARE SPECIFICATION FOR<br>MANUFACTURE OR PURCHASE   |
| 3. PREPARE INSTRUCTIONS FOR<br>MOUNTING                   |

OUTPUT

|  |                       |
|--|-----------------------|
| LABEL PLATE MFG SPECS<br>& MOUNTING INSTRUCTIONS | E.3.1<br>4.2.2<br>5.2 |
|--|-----------------------|

TO: NONE

BOX: 4.2.7

TITLE: LABEL PLATES

FROM: 4.2 CAMDAC

INPUT

PROCESS

OUTPUT

|         |  |
|---------|--|
| 3       | CONTRACT SPECS   |
| E.2     | VENDOR'S DRAWINGS<br>VENDOR'S DATA<br>CASUALTY REPORTS |
| 4.2.1   | MACHINERY LIST   |
| 4.2.3.1 | MACHINERY ARRANGEMENT<br>DRAWING                       |

|   |
|---|
| 1. REVIEW INPUTS  |
| 2. DEVELOP SCHEDULED MAINTENANCE INSTRUCTIONS FOR SPECIFIED MACHINERY AND EQUIPMENTS TO INCLUDE |
| a. TOOLS REQUIRED   |
| b. MATERIALS  |
| c. SKILL LEVEL  |
| d. FREQUENCY  |
| e. ELAPSED TIME   |
| f. SEQUENCE   |

|                                    |
|------------------------------------|
| SCHEDULED MAINTENANCE INSTRUCTIONS |
| E.3.1<br>E.3.2                     |

TO: NONE

BOX: 4.2.8

TITLE: SCHEDULED MAINTENANCE INSTRUCTIONS

FROM: 4.2 CAMDAC

INPUT PROCESS OUTPUT

|         |  |              |       |
|---------|--|--------------|-------|
| 3       | CONTRACT SPECS                             | TEST MEMOS   | E.3.1 |
| 4.2.5   | OPERATING INSTRUCTIONS                     |              | 5.2   |
| 4.2.6   | PLANT & ENGINEERING<br>SYSTEM INSTRUCTIONS | TEST RESULTS | E.1.3 |
| E.2     | COMPONENT TECHNICAL<br>MANUALS             |              |       |
| 4.2.1   | MACHINERY LIST                             |              |       |
| 4.3.1.4 | HYDRODYNAMIC REVIEW                        |              |       |
| 4.2.4   | DETAIL MACHINERY DRAWINGS                  |              |       |

1. PREPARE TEST MEMOS FOR INDIVIDUAL COMPONENT TESTS
2. PREPARE TEST MEMOS FOR SYSTEM TEST
3. PREPARE TEST MEMO FOR PLANT TEST (SEA TRIALS)
4. CONVERT TEST DATA TO DESIGN CONDITIONS
5. ANALYZE RESULTS TO ENSURE CONFORMANCE WITH CONTRACT REQUIREMENTS
6. PREPARE FINAL REPORT OF TEST RESULTS

TO: NONE

BOX: 4.2.9

TITLE: TEST SPECIFICATIONS



FROM: 4.2 CAMDAC

OUTPUT

|                |       |
|----------------|-------|
| ALLOWANCE LIST | E.3.1 |
|----------------|-------|

PROCESS

|                                 |
|---------------------------------|
| 1. PREPARE PARTS ALLOWANCE LIST |
|---------------------------------|

INPUT

|       |                   |
|-------|-------------------|
| E.2   | VENDOR'S DRAWINGS |
| 4.2.1 | MACHINERY LIST    |

TO: NONE

BOX: 4.2.10

TITLE: PARTS ALLOWANCE LIST

### HULDAC 4.3

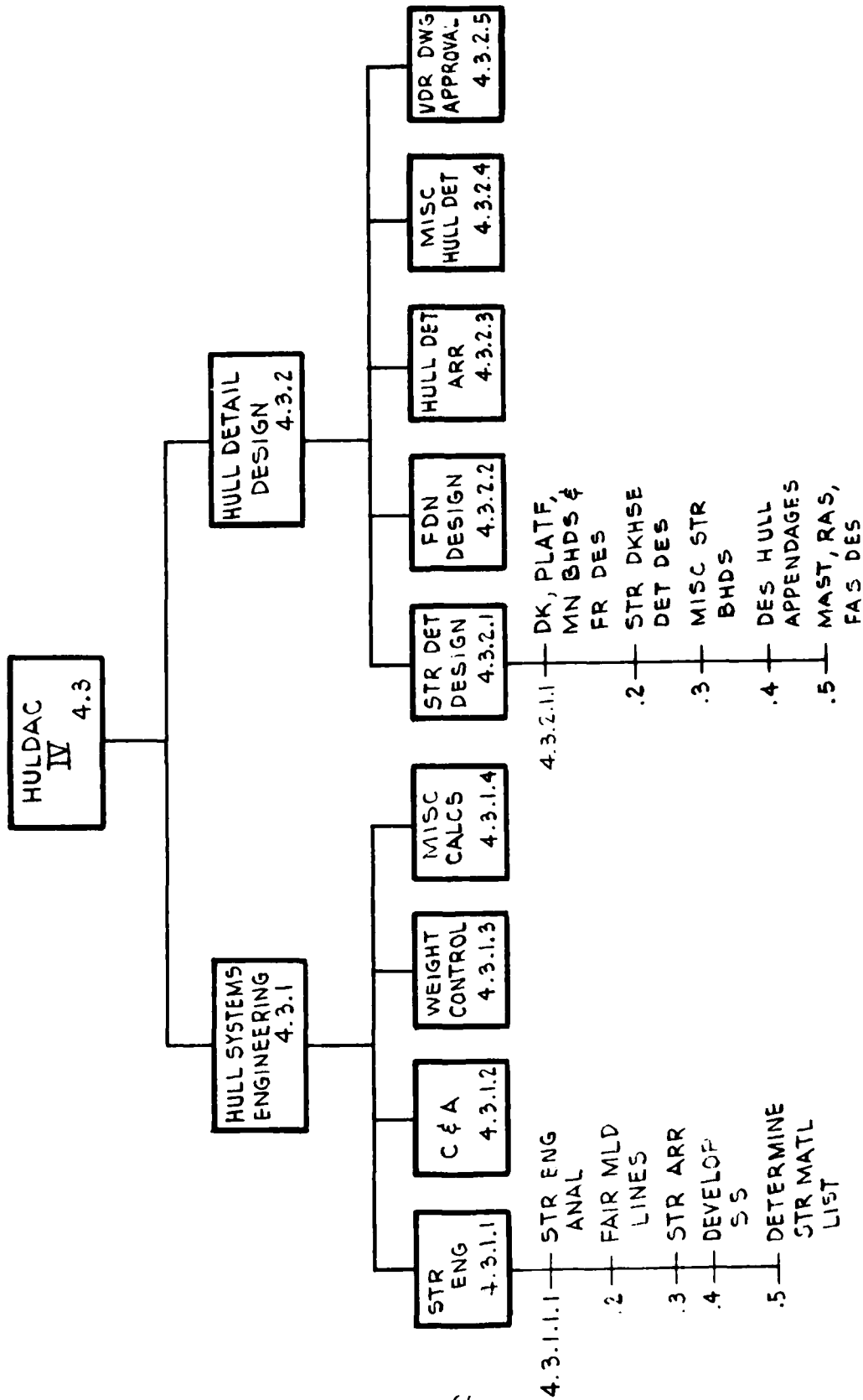
#### HIPO

#### DIAGRAMS

NOTE: The term "boiler plate" is used throughout the HULDAC HIPO diagrams to refer to a standard set of inputs which includes the following:

- GFI
- Change Data
- Identification Standards
- Q.A. Procedures
- Engineering Schedule
- Detail Design Schedule
- Design Approval

FROM: CASDAC LEVEL IV



TITLE: HULDAC STRUCTURE

FROM: 1.4 CASDAC LVL III

INPUT

PROCESS

OUTPUT

|       |                         |                                       |                          |           |
|-------|-------------------------|---------------------------------------|--------------------------|-----------|
| 3     | SPECS                   | 1. FINALIZE SYSTEM ENGINEERING        | CHANGE DATA (HULL)       | E.1.4.4.2 |
| 3     | SHELL EXPAN DWG LVL III | LEVEL DESIGN AND PERFORM              |                          | 4.4.4.8   |
| 3     | MLD HULL FORM LVL III   | DETAILED DESIGN FOR HULL              | STRUCTURAL ENG DOCS      | 5.3       |
| 3     | STRUCTURAL ARR LVL III  | FORM, STRUCTURE, ARR, AND HULL OUTFIT |                          | E.1.2     |
| 3     | C&A DWGS LVL III        |                                       | HULL DET DES DOCS        | E.1.7     |
| E.1.5 | GFI                     |                                       | SHIPS INSTRC DOCS        | 5.3       |
| E.1.4 | CHANGE DATA             |                                       | PURCHASE SPECS           | E.1.7     |
| YARD? | IDENTIFICATION STDS     |                                       | B/M'S, VARIOUS           | E.3.2     |
| YARD? | Q.A. PROCEDURES         |                                       | ENG SCH (HULL)           | E.3.1     |
| E.3.1 | ENG SCHEDULE            |                                       | DET DES SCH (HULL)       | E.3.1     |
| E.3.1 | DET DES SCHEDULE        |                                       | DOCKING PLAN GUIDANCE(?) | E.1.7     |
| E.3.1 | ERECTION PLAN           |                                       | WEIGHT REPORT            | E.1.2     |
| ?     | ENG PLAN                |                                       |                          |           |
| ?     | DET DES PLAN            |                                       |                          |           |
| E.1.2 | DESIGN APPROVAL         |                                       |                          |           |

TO: NONE

BOX: 4.3

TITLE: HULDAC IV

FROM: 4.3 HULDAC IV

INPUT

|   |                         |
|---|-------------------------|
| 3 | SHELL EXPAN DWG LVL III |
| 3 | MLD HULL FORM LVL III   |
| 3 | STRUCTURAL ARR LVL III  |
| 3 | C&A DWGS LVL III        |
| 3 | SPECS                   |
|   | BOILER PLATE            |

PROCESS

|    |  |
|----|--|
| 1. | REVIEW AND REVISE LVL III<br>HULL FORM, STRUCTURAL ARR, &<br>C&A TO ENSURE CONSISTENCY,<br>COMPLETENESS, & SATISFAC-<br>TION OF DESIGN CRITERIA,<br>AND TO ADJUST DESIGN FOR<br>YARD'S PRODUCIBILITY<br>CONSIDERATIONS |
| 2. | PRODUCE STRUCTURAL MATL<br>LIST AS BASIS FOR ORDER-<br>ING HULL STEEL  |

OUTPUT

|                          |   |
|--------------------------|---|
| STRUCTURAL ENG DWGS      | 4.2<br>4.4.4.8<br>5.3<br>E.1.2<br>E.1.7 |
| DOCKING PLAN GUIDANCE(3) | 5.3?<br>E.1.7?                          |
| TESTING GUIDANCES        | 5.3?                                    |
| SHIP INSTRUCTION DOCS    | E.1.7                                   |
| WEIGHT REPORT            | E.1.2                                   |

TO: 4.3.1.1, 4.3.1.2

BOX: 4.3.1

TITLE: HULL SYSTEMS ENGINEERING

FROM: 4.3.1 HULL SYSTEMS ENGINEERING

INPUT

PROCESS

OUTPUT

|         |                            |  |                        |         |
|---------|----------------------------|--|------------------------|---------|
| 3       | SHELL EXPAN DWG LVL III    | 1. REVIEW AND REVISE LVL III HULL FORM & STRUCTURAL ARR TO ENSURE CONSISTENCY, COMPLETENESS, & SATISFACTION OF DESIGN CRITERIA, AND TO ADJUST DESIGN FOR YARD'S PRO- DUCIBILITY CONSIDERATIONS | TECH NOTES & MEMOS     | 4.3.2   |
| 3       | MLD HULL FORM LVL III      | 2. PRODUCE STRUCTURAL MATL LIST, AS BASIS FOR ORDER- ING HULL STEEL  | SHELL EXPAN DWG        | 5.3     |
| 3       | STRUCTURAL ARR LVL III     | 3. PREPARE NOISE REDUCTION ACOUSTIC TREATMENT ANALYSIS   | MLD HULL FORM          | 4.3.2   |
| 3       | C&A DWGS LVL III           |  | STRUCTURAL ARR         | 4.3.1.2 |
| 3       | SPECS                      |  | SUPERSTR ARR DWG       | 4.3.1.2 |
| 4.3.1.1 | C&A DWGS                   |  | ADV STRUC MATL LIST    | 4.3.2   |
| 4.7.4.1 | BOILER PLATE               |  | WEIGHT DATA            | 4.3.1.3 |
| 4.7.5.1 | HVAC PENETRATIONS          |  | HOLES LIST             | 4.3.2   |
| 4.2.3.1 | FAN RM ARR                 |  | STRUC ENG DATA         | 4.3.1.2 |
| 4.2.3.1 | MACHY ARR DWGS (NOISE RED) |  | SURFACE AND STIFF.DATA | 4.2     |
| 4.2.3.2 | COMBUSTION AIR & UPTAKES   |  |                        | 4.4-4.8 |
| 4.2.3.3 | CONDENSER SCOOP            |  |                        | 5.3     |

TO: 4.3.1.1.1 THRU 4.3.1.1.6

BOX: 4.3.1.1

TITLE: STRUCTURAL ENGINEERING

FROM: 4.3.1 HULL SYSTEMS ENGINEERING

| INPUT   |                          | PROCESS   | OUTPUT   |
|---------|--------------------------|---|--|
| 3       | C&A DWGS LVL III         | 1. REVIEW AND REVISE LVL III<br>C&A DWGS TO ENSURE CONSISTENCY WITH LVL IV HULL FORM & STRUCTURAL ARRS; TO ENSURE COMPLETENESS, TO ENSURE SATISFACTION OF DESIGN CRITERIA<br><br>2. PRODUCE ACCESS LIST | C&A DRAWINGS<br><br><br><br>ACCESS LIST<br><br><br><br>E.3.2 |
| 4.3.1.1 | MLD HULL FORM            |   |  |
|         | STRUCTURAL ARR           |   |  |
|         | SUPRSTR STRUC ARR DWG    |   |  |
| 3       | SPECS                    |   |  |
| 4.7.1.1 | COMPT INSULATION LISTS   |   |  |
| 4.7.1.2 |                          |   |  |
| 4.7.1.3 |                          |   |  |
| 4.7.5.1 | BOILER PLATE             |   |  |
| 4.7.5.2 | FAN RM ARR               |   |  |
| 4.2.3.1 | VENT TRUNKS              |   |  |
| 4.2.3.2 | MACHY ARR                |   |  |
|         | COMBUSTION AIR & UPTAKES |   |  |

TO: NONE

BOX: 4.3.1.2

TITLE: DEVELOP C&A DRAWINGS

FROM: 4.3.1 HULL SYSTEMS ENGINEERING

INPUT PROCESS OUTPUT

|         |  |   |       |
|---------|--|---|-------|
| LVL III | SPECS  | WEIGHT REPORT   | E.1.2 |
| 4.3.2   | PREL WEIGHT ESTIMATE<br>ACCEPTED WEIGHT REPORT<br>STRUC DET DES WEIGHT<br>DATA | 1. PERFORM WEIGHT CONTROL<br>ENGINEERING TASK, PREPARE<br>WEIGHT REPORTS, AND CONDUCT<br>INCLINING EXPERIMENT |       |
| 4.3.1.1 | STRUC WEIGHT DATA  |   |       |
| 4.7.1   | INSULATION WEIGHT<br>CONTROL DATA  |   |       |
| 4.7.2.3 | HVAC WEIGHT ESTIMATE   |   |       |
| 4.2.1   | MACHY WEIGHT DATA  |   |       |
| 4.2.3.2 | COMBUSTION ARR &<br>UPTAKES  |   |       |
| 4.2.3.3 | CONDENSER SCOOP  |   |       |
| 4.5.4.7 | ELEC/ELEX WEIGHT DATA  |   |       |
| 4.4     | PIPING WEIGHT DATA   |   |       |

TO: NONE

BOX: 4.3.1.3

TITLE: WEIGHT CONTROL



FROM: 4.3.1 HULL SYSTEMS ENGINEERING

INPUT

PROCESS

OUTPUT

|           |                                       |  |                     |           |
|-----------|---------------------------------------|--|---------------------|-----------|
| 4.2.1.1.4 | INTERFACE DATA (POWER TRAIN)          | 1. PREPARE LAUNCHING CALCS, HYDRODYNAMIC REVIEW, DOCKING PLAN, AND MISC NAVAL ARCHITECTURE CALCS | HYDRODYNAMIC REVIEW | 4.2.9     |
| 4.2.1.1.5 | INTERFACE DATA (AUXILIARY PROPULSION) |  | CROSS FLOODING ANAL | E.1.2.4.8 |
| LVL III   | SPECS                                 |  | DOCKING PLAN        | E.1.2     |
|           | GUIDANCE DRAWINGS                     |  |                     |           |

TO: NONE

BOX: 4.3.1.4

TITLE: NAVAL ARCHITECTURE CALCULATIONS

FROM: 4.3 HULDAC IV

INPUT

|       |                     |
|-------|---------------------|
| 3     | SPECIFICATIONS      |
| E.1.4 | CHANGE DATA         |
| E.1.5 | CFI                 |
| 4.3   | STRUCTURAL ENG DOCS |
| 4.3.1 | STDS & Q.A. PROC    |
| YARD? |                     |
| E.3.1 | DET DES SCHEDULE    |
| E.1.2 | DESIGN APPROVAL     |
| 4.8   | DESIGN ERROR NOTES  |

PROCESS

|  |
|--|
| 1. PROVIDE HULL STR DETAIL DES,<br>FDN DES, HULL DET ARR, MISC<br>HULL DETS AND VENDOR DWG<br>APPROVAL |
|--|

OUTPUT

|                       |                                       |
|-----------------------|---------------------------------------|
| CHANGE DATA           | E.1.4<br>4.2<br>4.4-4.8               |
| HULL DET DES DOCS     | 5.3<br>E.1.2<br>5.3<br>4.2<br>4.4-4.8 |
| SHIP INSTR BOOKS      | E.1.7                                 |
| PURCHASE SPECS (?)    | E.3.2                                 |
| COMMENT/APPROVAL LTRS | E.3.2                                 |
| B/M'S, VARIOUS        | E.3.2                                 |
| DET DES SCH           | E.3.1                                 |

TO: 4.3.2.1, 4.3.2.2, 4.3.2.3, 4.3.2.4, 4.3.2.5

BOX: 4.3.2

TITLE: HULL DETAILED DESIGN

FROM: 4.3.2 HULL DET DES

INPUT

PROCESS

OUTPUT

|         |                          |                    |         |
|---------|--------------------------|--------------------|---------|
| 3       | SPECS                    | STRUC DET DES DOCS | LVL V   |
| E.1.4   | CHANGE DATA              |                    | 4.2     |
| E.1.5   | GFI                      |                    | 4.4-4.8 |
| 4.3.1   | STDS & Q.A. PROC         | CHANGE DATA        | ??      |
| YARD    | GFI                      | DESIGN INTEG       | 4.8     |
| E.3.1   | DET DES SCH              | DET DES SCH        |         |
| E.1.2   | DES APPROVAL             |                    |         |
| 4.8     | DES ERROR NOTES          |                    |         |
|         | DES INTEG                |                    |         |
| 4.2.3.1 | MACHY ARR DWG            |                    |         |
| 4.2.3.2 | COMBUSTION AIR & UPTAKES |                    |         |
|         | DET DES PLAN?            |                    |         |
| 4.7.5.2 | VENT TRUNKS              |                    |         |

1. DEVELOP MAJOR STR DET DES DWGS, DKS, PLATS & FRAMING, STRUCTURAL DKHSE DES, MISC STR BHDS, HULL APPENDAGES, MAST, FAS TRAS DES

TO: NONE

BOX: 4.3.2.1

TITLE: STRUCTURAL DETAIL DESIGN

FROM: 4.3.2 HULL DET DES

INPUT

PROCESS

OUTPUT

|         |                    |
|---------|--------------------|
| 4.3.2.1 | STRUC DET DES DOCS |
| E.2     | ARR DWGS           |
| 3       | VENDOR DWGS        |
| E.1.4   | SPECIFICATIONS     |
| E.1.5   | CHANGE DATA        |
| 4.3.1   | CFI                |
| YARD    | STDS & Q.A. PROC   |
| E.3.1   | DET DES SCH        |
| E.3.2.1 | DES APPROVAL       |
| 4.0     | DES ERROR NOTES    |
| 4.2.3.1 | MACHY ARR          |
| 4.2.4   | MACHY DETS         |
|         | DET DES PLAN?      |

|              |                       |
|--------------|-----------------------|
| FDN DES DOCS | 5.3<br>4.2<br>4.4-4.8 |
| CHANGE DATA  | ??                    |
| DET DES SCH  | E.3.1                 |

|                                  |
|----------------------------------|
| 1. PROVIDE DETAILED FDN DES DWGS |
|----------------------------------|

TO: NONE

BOX: 4.3.2.2

TITLE: FOUNDATION DESIGN

FROM: 4.3.2 HULL DET DES

# INPUT

|         |                            |
|---------|----------------------------|
| 4.3.1.1 | SHELL EXPANSION DMC        |
| 4.3.1.1 | MOLDED HULL FORM           |
| 4.3.1.1 | STR ARR DMC                |
| 4.3.1.1 | SUPSTR STR ARR DMC         |
| 4.3.1.1 | CAA DMC OF PIPE HANGERS.   |
| 4.3.1.2 | PIPING DIAGREL ARR DMC     |
|         | PWR SYS DIAG               |
|         | MAIN CABLEWAY ROUTING      |
|         | HVAC SYS DIAG              |
|         | TECH MAN FOR EQUIP         |
| 4.3.2.1 | MISC STR BHD DMC           |
| 4.3.2.1 | STR DRHOUSE DET DMC        |
| 4.3.2.1 | DKS. PLATE, HVRBD & FR DMC |
| 4.3.2.4 | DK COVERING                |
| 4.3.2.4 | SHIPS INSULATION           |
| 4.3.2.4 | SHEATHING                  |
| 4.3.2.4 | NON-STR BHD DMC            |
| 4.3.2.4 | COMPT LIGHT DMC            |
|         | MAIN CABLEWAY DK ARR       |
|         | HVAC DUCTS ARR DMC         |
|         | PLUMBING SYS DMC           |
|         | POTABLE WATER SYS DMC      |
|         | PIPING ARR & DET DMC       |
|         | INSULATION LIST            |
|         | SPECIFICATIONS             |
|         | CHANGE DATA                |
|         | GFI                        |
| 4.7.1.2 | DRAWINGS                   |
| 3       | VENDOR DMC                 |
| E.1.4   | COMMERCIAL CATALOGS        |
| E.1.5   | DET DES SCHEDULE           |
| E.2     | DES ERROR NOTES            |
| E.3.1   | DES APPROVAL               |
| 4.8     |                            |
| E.1.2   |                            |

# PROCESS

|   |
|---|
| 1. REVIEW LVL 3 SPECS, CFI & GUIDANCE DMC                                       |
| 2. LAYOUT COMPT CONFIGURATION ACCESSES & STR                                    |
| 3. PREPARE PRELIMINARY DET ARR  |
| 4. CONDUCT DESIGN LIAISON WITH APPLICABLE HVAC, PIPING, ELEC/ ELEX, STR SOURCES |
| 5. PRODUCE FINAL HULL DET ARR DMC   |

# OUTPUT

|                               |         |
|-------------------------------|---------|
| COMMISSARY SPACES & EQUIP DMC | 5.3     |
| REEFER SPACE DMC              | 4.2     |
| STOREROOM DMC                 | 4.4-4.8 |
| LIVING & OFFICE SPACE DMC     |         |
| FURNITURE LISTS               |         |
| UTILITY & WORKSHOP SPACE DMC  |         |
| MEDICAL SPACES                | E.3.2?  |
| B/M                           | 5.3     |
| TECHNOTES & MEMOS             | E.3.2   |
| PURCHASE SPECS                | E.3.2   |
| COMMENT APPROVAL LTRB         | E.3.1   |
| DET DES SCR                   | E.1.4   |
| CHANGE DATA                   | 4.2     |
|                               | 4.4     |
| TEST INFO                     | 7       |
| COMPT HEAT LOADS              | 4.7.3.1 |

TO: NONE

BOX: 4.3.2.3

TITLE: HULL DETAIL ARRANGEMENT

FROM: 4.3.2 HULL DET DES

# INPUT

4.3.1.2 C&A DWGS  
4.3.1.1 STR ARR DWG  
4.3.1.1 SUPERSTR STR ARR DWG  
4.3.2.1 MISC STR BHD DWG  
4.3.2.1 STR DKHSE DET DWG  
4.3.2.1 DFS, PLATE, MNBHD&DR DWG  
4.3.1.1 SHELL EXPANSION DWG  
4.3.1.1 MOLDED HULL FORM  
3 SPECIFICATIONS  
3 DRAWINGS  
E.1.4 CHANGE DATA  
E.1.5 GFT  
E.2 VENDOR DWGS  
E.2 COMMERCIAL CATALOGS

# PROCESS

1. REVIEW LVL 3 SPECS, GFI & GUIDANCE DWGS
2. PREPARE DET DES DWGS FOR:  
MISC NON-STR BHDS  
TOILET & STR PARTITIONS  
CANVAS LIST  
LIGHT TRAPS  
DRAFT MARKS & SHIP'S NAME  
LABEL PLATES & CLOSURE  
CLASSIFICATION LIST  
SHIPS INSULATION  
PAINT SCHEDULE  
DECK COVERING  
SHEATHING  
LOCK KEY TAG & RING LIST  
SHIPS DATA PLAQUE & NAME BOARD

# OUTPUT

MISC HULL DETAILED DES DOC  
B/M'S  
TECH NOTES & MEMOS  
PURCHASE SPECS  
COMMENT APPROVAL LTRSS  
DET DES SCH  
CHANGE DATA

5.3  
E.3.2  
5.3  
E.3.2  
E.3.2  
E.3.1  
E.1.4  
4.2  
4.4

TO: NONE

BOX: 4.3.2.4

TITLE: MISCELLANEOUS HULL DETAIL

FROM: 4.3.2 HULL DET DES

INPUT

|         |   |
|---------|---|
| 4.3.2.1 | SPECIFICATIONS<br>PURCHASE SPECS<br>PURCHASE ORDERS<br>RECEIVE RECORDS<br>VENDOR DWGS<br>CFE DWCE |
|---------|---|

PROCESS

|  |
|--|
| 1. REVIEW VENDOR DWGS FOR<br>APPLICABILITY |
| 2. CHECK VENDOR CALCULATIONS               |
| 3. PREPARE COMMENT/APPROVAL<br>LTRS        |
| 4. RESUBMIT VENDOR DWGS AS<br>REQUIRED     |
| 5. REPEAT PROCESS AS REQUIRED              |

OUTPUT

|                       |  |
|-----------------------|--|
| COMMENT/APPROVAL LTRS |  |
|-----------------------|--|

TO: NONE

BOX: 4.3.2.5

TITLE: VENDOR DWG APPROVAL

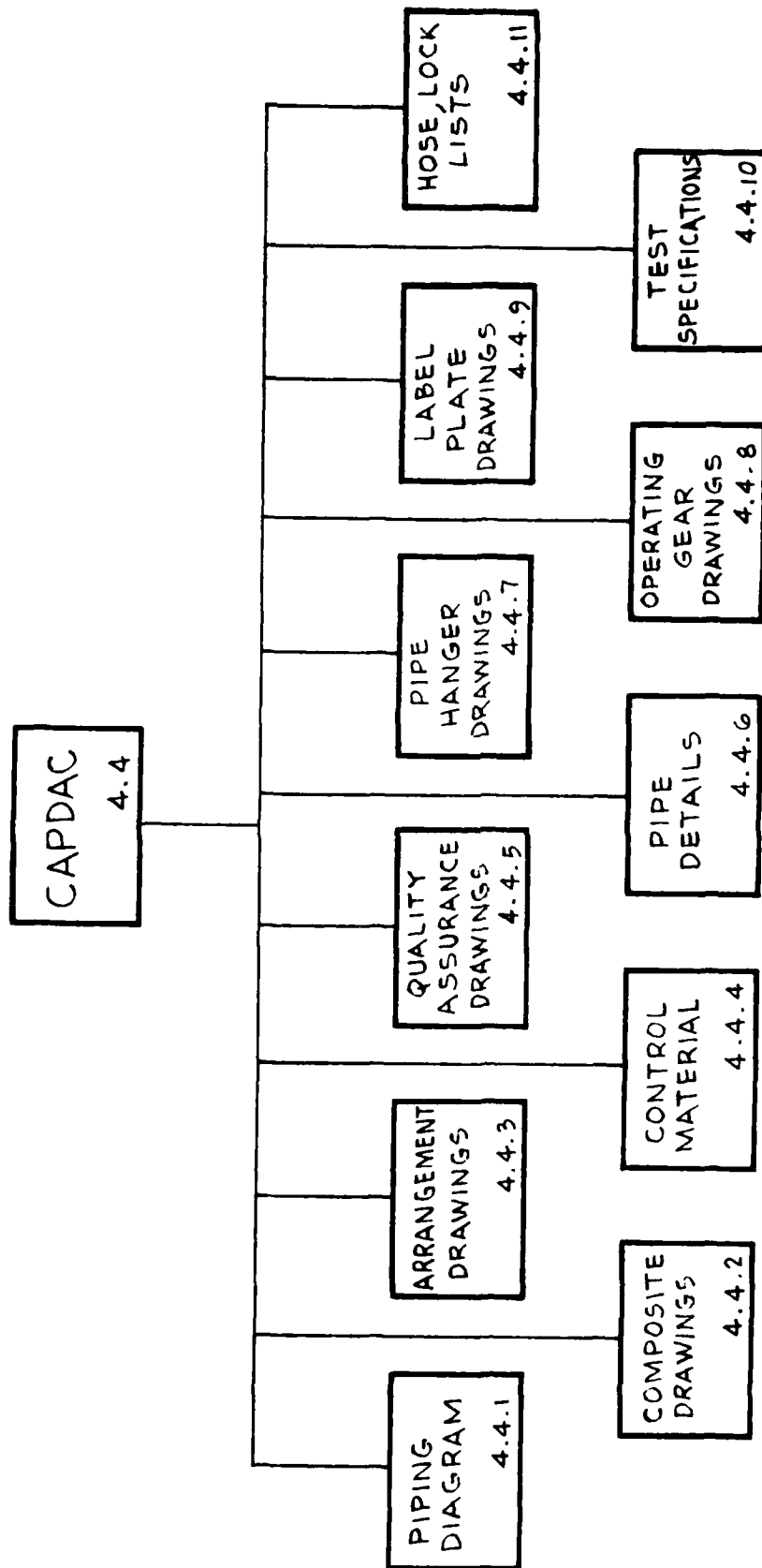
CAPDAC 4.4

HIPO

DIAGRAMS



FROM: CASDAC LEVEL IV



TITLE: CAPDAC STRUCTURE

FROM: 4 CASDAC LEVEL IV

INPUT

|   |  |
|---|--|
| 3 | DETAIL SPECIFICATIONS                        |
| 3 | CONTRACT GUIDANCE<br>DRAWINGS                |
|   | CATALOG DATA                                 |
|   | MILITARY SPECS                               |
|   | INTERFACES WITH CASDAC<br>FUNCTIONAL SYSTEMS |

PROCESS

|                             |
|-----------------------------|
| 1. INTERPRET SPECIFICATIONS |
| 2. DRAW                     |
| 3. WRITE                    |
| 4. CALCULATE                |
| 5. TEST                     |
| 6. PROCURE                  |

OUTPUT

|   |                   |
|---|-------------------|
| DRAWINGS                                    | 5.4<br>E.3        |
| LISTS                                       |                   |
| INSTRUCTIONS                                | 4.1<br>4.2<br>4.3 |
| TESTS FOR PROCUREMENT                       | 4.5<br>4.6        |
| INTERFACES WITH OTHER<br>FUNCTIONAL SYSTEMS | 4.7<br>4.8        |

TO: 4.4.1 THRU 4.4.11

BOX: 4.4

TITLE: CAPDAC

FROM: 4.4 CAPDAC

INPUT

|         |  |
|---------|--|
| 3       | CONTRACT SPECS   |
| 3       | CONTRACT & GUIDANCE<br>DRAWINGS  |
| 4.2.3.1 | MACHINERY ARR DWGS   |
| 4.5     | C & A DWGS   |
| 4.7.4.1 | ELECTRICAL DWGS  |
| 4.4.3   | HVAC DIAGRAMMATIC<br>INTERFACE DATA OTHER<br>PIPING SYSTEM/DIAGRAM<br>DATA FROM CATALOGS,<br>PIPES, VALVES, FITTINGS,<br>STRAINERS, ETC.<br>MIL STDS 777/438<br>SPECIFICATIONS<br>MACHINERY LIST |
| 4.2.1   |  |

PROCESS

|    |   |
|----|---|
| 1. | REVIEW SPECS & CONTRACT<br>GUIDANCE DRAWINGS  |
| 2. | PREPARE DIAGRAM SKETCH  |
| 3. | MAKE ENGINEERING CALCS, LOGIS-<br>TICS SUPPORT ANALYSIS (LSA)                                       |
| 4. | ESTABLISH SYSTEM DESIGN<br>PARAMETERS   |
| 5. | ESTABLISH DATA FOR PIPE<br>SIZING AND CALC PIPE SIZES   |
| 6. | MAKE CALCS FOR SPECIAL<br>VALVES, PIPE THICKNESS,<br>HEAT EXCH, RELIEF VALVE,<br>ORIFICES, ETC.     |
| 7. | PREPARE LISTS, VALVES,<br>FITTINGS, INSTRUMENTS,<br>STRAINERS, HOSE, PUMP,<br>CHARACTERISTICS, ETC. |
| 8. | PREPARE DIAGRAM WITH GRA-<br>PHICS, LISTS, SCHEDULES,<br>NOTES, TABLE, REFERENCES                   |
| 9. | PREPARE PREL LIST MAT   |

OUTPUT

|  |   |
|--|---|
| FOR EACH PIPING SYSTEM<br>DIAGRAMMATIC DRAWING | 4.4.2<br>4.4.3<br>4.4.4<br>4.4.5<br>4.4.6<br>4.4.7<br>4.4.8<br>4.4.9<br>4.4.10<br>4.4.11<br>4.2.4<br>4.2.5<br>4.2.6 |
|--|---|

TO: NONE

BOX: 4.4.1

TITLE: PIPING DIAGRAM

FROM: 4.4 CAPDAC

OUTPUT

4.4.3  
4.4.7  
4.4.8  
4.2  
4.5  
4.7

COMPOSITE DRAWINGS FOR  
EACH DESIGNATED SPACE  
FOR THE SHIP

PROCESS

1. SELECT AREA OF SHIP FOR WHICH COMPOSITE IS TO BE PREPARED
2. ASSEMBLE APPROPRIATE INPUTS
3. PREPARE BACKGROUND DWG OF SHIP'S STRUCTURE
4. PREPARE REL LAYOUT OF MACHINERY AND EQUIPMENT FOLLOWING RULES OF SPECS
5. PREPARE LAYOUT OF NETWORK SYSTEMS SUCH AS PIPING, VENTILATION AND WIREWAYS TO MEET THE RULES OF THE SPECS, HUMAN ENGINEERING FACTORS AND TO AVOID INTERFERENCES
6. MAKE CALCS I.E. PIPING FLEXIBILITY REVIEW, PIPE STRESS, NOISE ATTENUATION, ETC.

INPUT

C & A DRAWINGS  
STRUCTURE  
MACHINERY ARRS  
VENTILATION DWGS  
ELECTRICAL EQUIPT  
AND WIREWAYS  
MOLDED HULL FORM  
PIPING, VENT., ELEC-  
TRICAL DIAGRAMS  
MACHINERY LISTS  
DETAIL SPECIFICATIONS  
HUMAN ENGINEERING  
FACTORS

4.3.1.2  
4.3.2.1  
4.2.3.1  
4.7.6.1  
4.5  
4.3.1.1  
4.2.1  
3

TO: NONE

BOX: 4.4.2

TITLE: COMPOSITE DRAWINGS

FROM: 4.4 CAPDAC

INPUT

PROCESS

OUTPUT

|  |  |
|--|--|
| 4.4.1<br>4.4.2<br>4.4.4<br>5.4<br>3<br>4.4.4 | DIAGRAMMATIC DWG<br>COMPOSITE DWG<br>MATERIAL CATALOG DATA<br>SHOP FABRICATION DATA<br>DETAIL SPECIFICATIONS<br>FOR SHIP<br>MATERIAL CONTROL |
|--|--|

|   |
|---|
| 1. DRAWING SCHEDULE<br>2. REVIEW DIAGRAM TO DETERMINE INTERCONNECTS, PIPE SIZES, MATERIAL REQUIREMENTS, ETC.<br>3. MAKE CALCS (ITERATION FROM COMPOSITE) IF REQUIRED<br>4. FROM COMPOSITE DRAW BACK-GROUND AND RUN OF PIPING<br>5. DRAW GAGES, DRAIN CONNECTIONS, ETC.<br>6. DRAW LABELS & DIMENSIONS<br>7. WRITE NOTES & DATA<br>8. DRAW TITLE BLOCK, BORDER, ETC.<br>9. PREPARE DRAFT OF LIST OF MATERIAL<br>10. INTERACT WITH MATERIAL CONTROL FOR SOURCE DATA, ETC.<br>11. PREPARE FINAL LIST OF MATERIAL |
|---|

|   |   |
|---|---|
| PIPING ARRANGEMENT DWGS<br>LIST OF MATERIAL | E.3.1<br>E.3.2<br>5.4<br>4.4.4<br>4.4.5<br>4.4.6<br>4.4.7<br>4.4.8<br>4.4.9<br>4.4.11<br>4.3<br>4.5 |
|---|---|

TO: NONE

BOX: 4.4.3

TITLE: ARRANGEMENT DRAWINGS

FROM: 4.4 CAPDAC

INPUT

|  |   |
|--|---|
| 4.4.1<br>4.4.3<br>4.4.1<br>4.4.3<br>3<br>NAVSHIPS<br>0948-<br>7010 | PIPING MATERIAL<br>MASTER CATALOG FILE<br>PIPING DIAGRAMMATIC<br>PIPING ARR DWG<br>DRAFT OF PIPING<br>LIST OF MATERIAL<br>DETAIL SPECIFICATIONS<br>MIC REQUIREMENTS |
|--|---|

PROCESS

|  |
|--|
| 1. MAINTAIN MATERIAL ESTIMATES FOR A SHIP OR SHIPS<br>2. TRADE OFF MATERIAL BETWEEN SYSTEMS ON A SHIP/S<br>3. NEGOTIATE SUBSTITUTIONS OF MATERIAL BETWEEN DESIGN/ENG AND OTHER DEPTS<br>4. MAINTAIN STATUS OF MATL ON ORDER<br>5. HIGHLIGHT DIFFERENCES BETWEEN ROUGH ESTIMATES OF MATL, REFINED ESTIMATES & FINAL LISTS OF MATL<br>6. PROVIDE DATA FOR MAKE-OR-BUY DECISIONS<br>7. COORDINATE SHIP CONSTRUCTION<br>8. SCH & MATL LEAD TIMES TO PERMIT ORDERING ON A TIMELY SCHEDULED BASIS<br>9. SUM LIKE ITEMS FOR BULK ORDERING<br>10. INVOKE MIC |
|--|

OUTPUT

|  |                                   |
|--|-----------------------------------|
| PIPING LIST OF MATERIAL FOR EACH PIPING ARRANGEMENT ON A SHIP/CLASS OF SHIPS | E.3.1<br>E.3.2<br>4.4.11<br>4.4.3 |
|--|-----------------------------------|

TO: NONE

BOX: 4.4.4

TITLE: CONTROL MATERIAL

FROM: 4.4 CAPDAC

INPUT

PROCESS

OUTPUT

|       |   |
|-------|---|
| 4.4.3 | PIPING ARR DWGS                         |
| 3     | DETAIL SPECS                            |
| E.3.1 | LIBRARY OF JOINT I.D. NUMBERS           |
|       | SHOP DATA - WELDING BRAZING RADIOGRAPHY |

|  |
|--|
| 1. REFORMAT PIPING ARR DWG TO A FORMAT TO ACCEPT JOINT I.D. NUMBERS  |
| 2. ADD JOINT I.D. NUMBERS FROM LIBRARY   |
| 3. PREPARE A TABLE OF ASSIGNED NUMBERS AND ASSOCIATED DATA: TYPE WELD; PIPE SIZE; DEGREE OF RADIOGRAPHY, MAGNETIC PARTICLE OR LIQUID PENETRANT TESTING, SHOP WELD, DETAIL NUMBER |
| 4. PREPARE NOTES AND REFERENCES  |
| 5. WHEN DWG CHANGES ARE MADE THE LIST OF JOINT I.D. NUMBERS IS MAINTAINED  |

|  |       |
|--|-------|
| <ul style="list-style-type: none"> <li>JOINT IDENTIFICATION DRAWING FOR SPECIFIED WELDED OR BRAZED PIPING SYSTEMS</li> </ul> | 5.4   |
| <ul style="list-style-type: none"> <li>TABLE OF JOINTS AND NOTES</li> </ul>  | E.3.1 |
| <ul style="list-style-type: none"> <li>LIST OF UNASSIGNED JOINT I.D. NUMBERS OR DELETED NUMBERS</li> </ul>                   |       |

TO: NONE

BOX: 4.4.5

TITLE: QUALITY ASSURANCE DRAWINGS

FROM: 4.4 CAPDAC

INPUT

PROCESS

OUTPUT

|       |  |
|-------|--|
| 4.4.3 | PIPING ARR DWGS  |
| 4.4.5 | JOINT I.D. DWG<br>MATERIAL CATALOG<br>PIPING COMPONENT<br>DIMENSIONS |
| 5.4   | TOOLING DATA FROM<br>PIPE SHOP                                       |

|  |
|--|
| 1. SELECT PORTION OF PIPE TO<br>BE DETAILED FROM ARR DWG |
| 2. PREPARE SKETCH  |
| 3. PREPARE INSTRUCTIONS                                  |
| 4. PREPARE L/M FOR DETAIL                                |
| 5. ADD JOINT IDENTIFICATION<br>IF REQUIRED               |

|                             |       |
|-----------------------------|-------|
| PIPE DETAIL DWG             | E.3.1 |
| FABRICATION INSTRS          | E.3.2 |
| MATERIAL LIST FOR<br>DETAIL | 5.4   |

TO: NONE

BOX: 4.4.6

TITLE: PIPE DETAILS



FROM: 4.4 CAPDAC

INPUT

|       |   |
|-------|---|
| 4.4.2 | COMPOSITE DRAWING   |
| 4.3   | STRUCTURAL DRAWINGS<br>CATALOG OF PIPE HANGERS,<br>SWAY BRACES, ETC.<br>CATALOG OF ATTACHMENT<br>HARDWARE<br>HANGER LOADS AND PIPE<br>MOVEMENTS FROM PIPE<br>FLEXIBILITY ANALYSIS<br>STANDARD NOTES |
| 4.4.3 |   |

PROCESS

|   |
|---|
| 1. DETERMINE LOCATION OF HANGERS (INCL.<br>(INCLUDING VARIABLE SUPPORT, FIXED<br>AND SWAY BRACES) |
| 2. LOCATE & NO. SUPPORT POINTS  |
| 3. CALCULATE EACH SUPPORT POINT LOAD &<br>MOVEMENT  |
| 4. DETERMINE CENTERLINE RUN OF EACH<br>HANGER SYS FROM PIPE TO STRUCTURE                          |
| 5. SELECT PROPER HANGER FOR EACH<br>SUPPORT POINT   |
| 6. CHECK THAT HANGERS ARE COMPATIBLE<br>WITH HANGER RUNS  |
| 7. SELECT HARDWARE FOR EACH SUPPORT<br>POINT  |
| 8. CHECK THAT HARDWARE IS COMPATIBLE<br>WITH HANGERS & HANGER RUNS                                |
| 9. SELECT TITLE & NO. FOR HANGER ARR,<br>L/M & DET DWGS   |
| 10. PREPARE PIPE HANGER ARR DWG   |
| 11. PREPARE LIST OF MATERIAL  |
| 12. PREPARE HANGER DETAIL DWGS  |

OUTPUT

|                         |       |
|-------------------------|-------|
| PIPE HANGER ARR DWG     | 5.4   |
| PIPE HANGER DETAIL DWGS | E.3.1 |
| PIPE HANGER L/M         | E.3.2 |

TO: NONE

BOX: 4.4.7

TITLE: PIPE HANGER DRAWINGS

FROM: 4.4 CAPDAC

INPUT

PROCESS

OUTPUT

|         |                                  |   |                            |       |
|---------|----------------------------------|---|----------------------------|-------|
| 4.4.1   | PIPING DIAGRAM                   | 1. IDENTIFY VALVES REQUIRING OPERATING GEAR               | OPERATING GEAR ARR DWG     | 5.4   |
| 4.4.3   | PIPING ARR DWG                   | 2. PREPARE CENTERLINE ARR OF OPERATING GEAR               | OPERATING GEAR L/M         | E.3.1 |
| 4.4.2   | COMPOSITE DWG                    | 3. SELECT PROPER OPERATING GEAR COMPONENTS                | OPERATING GEAR DETAIL DWGS | E.3.2 |
| 4.3.2.1 | STRUCTURAL DWGS                  | 4. ARRANGE COMPONENTS ON CENTERLINE RUN OF OPERATING GEAR |                            |       |
|         | VALVE OPERATING GEAR DESIGN DATA | 5. PREPARE L/M  |                            |       |
|         | VALVE OPERATING GEAR CATALOG     | 6. SELECT PARTS OF ARR FOR ENLARGEMENT OR EXPLODED VIEWS  |                            |       |
|         |                                  | 7. PREPARE DETAILS OF NON-STANDARD PARTS                  |                            |       |
|         |                                  | 8. ANALYZE AND MAKE CALLS FOR NON-STANDARD PARTS          |                            |       |
|         |                                  | 9. PREPARE NOTES  |                            |       |
|         |                                  | 10. PREPARE ARR DWG                                       |                            |       |
|         |                                  | 11. PREPARE DETAIL DWG                                    |                            |       |

TO: NONE

BOX: 4.4.8

TITLE: OPERATING GEAR DRAWINGS

AD-A085 749

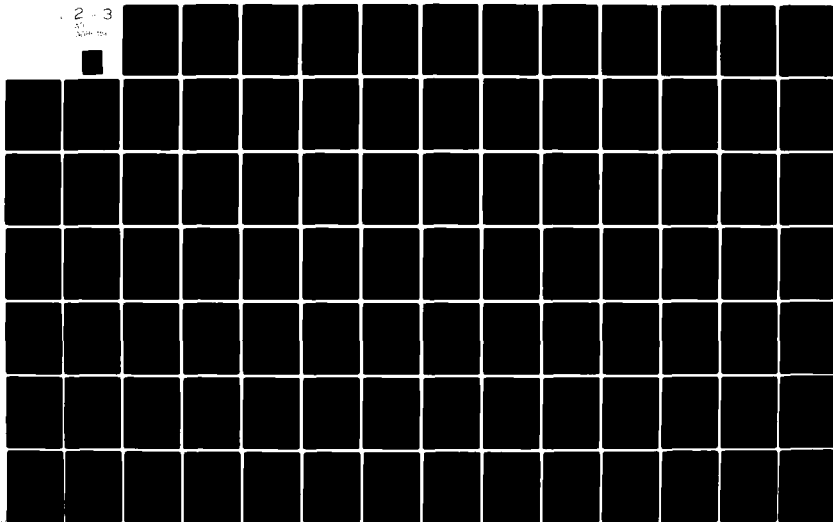
DAVID W TAYLOR NAVAL SHIP RESEARCH AND DEVELOPMENT CE--ETC F/G 13/10  
FEASIBILITY MODEL OF CASDAC LEVEL IV/V TOP-DOWN ANALYSIS, (U)  
APR 79 R JENKINS, B M THOMSON  
DTNSROC/CMLD-79-06

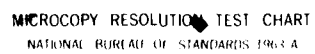
UNCLASSIFIED

NL

2-3

100-100





MICROCOPY RESOLUTION TEST CHART  
NATIONAL BUREAU OF STANDARDS-1963-A

FROM: 4.4 CAPDAC

INPUT

|         |                  |
|---------|------------------|
| 4.4.1   | LABEL PLATE STDS |
| 4.4.3   | PIPING DIAGRAM   |
|         | PIPING ARR DWG   |
|         | OPERATIONS DATA  |
| 4.3.1.2 | C&A DWGS         |

PROCESS

|   |
|---|
| 1. SELECT COMPONENTS THAT REQUIRE LBLS            |
| 2. DETERMINE INSCRIPTIONS                         |
| 3. DETERMINE FORMAT                               |
| 4. IDENTIFY EACH LBL BY UNIQUE NO. AND COMPT      |
| 5. PREPARE LIST OF LBL PL FOR EACH PIPING SYS     |
| 6. PREPARE LIST OF LBL PL FOR ALL SYSS IN A COMPT |

OUTPUT

|  |       |
|--|-------|
| LABEL PLATE LIST FOR EACH PIPING SYS     | 5.4   |
| LIST OF LABEL PL FOR ALL SYSS IN A COMPT | E.3.1 |
| FORMAT FOR EACH LABEL PLATE              | E.3.2 |
| INSTALLATION SCHEDULE                    |       |

TO: NONE

BOX: 4.4.9

TITLE: LABEL PLATE DRAWINGS

FROM: 4.4 CAPDAC

PROCESS

INPUT

|  |   |                                      |
|--|---|--------------------------------------|
| <p>4.4</p> <p>4.4</p> <p>3</p> <p>4.4.1</p> <p>E.2</p>   | <p>LIBRARY OF TEST SPECS</p> <p>LIBRARY OF PROCESS INSTRUCTIONS</p> <p>DETAIL SPECIFICATIONS</p> <p>DIAGRAMMATIC DRAWING</p> <p>COMPONENT TECHNICAL MANUALS</p> |                                      |
| <p>1. REVIEW LIBRARY OF TEST SPECS</p> <p>2. REVIEW LIBRARY OF PROCESS INSTRUCTIONS</p> <p>3. REVIEW DETAIL SPECS</p> <p>4. PREPARE TEST SPEC FOR EACH PIPING SYS</p> <p>5. PREPARE LIST OF TEST FOR SHIP'S PIPING SYS</p> <p>6. ANALYZE TEST RESULTS TO INSURE CONFORMANCE WITH REQUIREMENTS</p> <p>7. PREPARE FINAL REPORT OF TEST RESULTS</p> |   |                                      |
| <p>PIPING SYSTEM TEST SPECIFICATION</p> <p>LIST OF TESTS FOR A SHIP'S PIPING SYSTEM</p> <p>TEST RESULTS</p>  |   | <p>E.3.1</p> <p>5.4</p> <p>E.1.3</p> |

TO: NONE

BOX: 4.4.10

TITLE: TEST SPECIFICATIONS

FROM: 4.4 CAPDAC

INPUT

|       |  |
|-------|--|
| 4.4.3 | PIPING ARR DWGS  |
| 4.4.4 | PIPING L/M FOR EACH<br>PIPING ARR ON A SHIP/<br>CLASS OF SHIPS |
| 4.4.1 | PIPING DIAGRAMS  |
| 3     | DETAIL SPECS   |

PROCESS

|    |   |
|----|---|
| 1. | REVIEW ALL LISTS OF MATERIAL<br>FOR PIPING SYSTEMS AND SE-<br>LECT OUT HOSES, LOCKS, ETC. |
| 2. | PREPARE LISTS OF HOSES,<br>LOCKS, ETC. WITH ALL THE<br>ASSOCIATED ATTRIBUTES              |

OUTPUT

|       |  |
|-------|--|
| 5.4   | LIST OF LOCKS FOR A<br>SHIP                            |
| E.3.1 | LIST OF HOSES FOR A<br>SHIP                            |
|       | OTHER LISTS AS<br>REQUIRED BY DETAIL<br>SPECIFICATIONS |

TO: NONE

BOX: 4.4.11

TITLE: HOSE, LOCK, ETC. LIST

ELXDAC 4.5

HIPO

DIAGRAMS





FROM: 4.0 CASDAC LEVEL IV

PROCESS

INPUT

|  |                                     |  |                      |
|--|-------------------------------------|--|----------------------|
| 3                                      | CONTRACT SPECS                      | 5                                      | DRAWINGS             |
| 3                                      | CONTRACT GUIDANCE<br>DRAWINGS       | E.3<br>E.1                             |                      |
| 3                                      | GFE/GFI                             | E.3.2<br>4.8                           | EQUIPMENT LISTS      |
| E.2                                    | VENDOR DATA                         | 4.2<br>4.3<br>4.4<br>4.6<br>4.7<br>4.5 | INTERFACE DATA       |
| 4.2<br>4.3<br>4.4<br>4.5<br>4.6<br>4.7 | INTERFACE DATA                      |  |                      |
| 4.5                                    | INFO ON OTHER ELEC/<br>ELEX SYSTEMS | E.3.2                                  | PROCR SPECIFICATIONS |
| 4.8                                    | DESIGN INTEGRATION                  | E.1<br>E.2<br>5                        | TEST SPECIFICATIONS  |

TO: 4.5 THRU 4.5.8

BOX: 4.5

TITLE: ELXDAC

FROM: 4.5 ELXDAC

INPUT

|           |  |
|-----------|--|
| 3         | CONTRACT SPECS                             |
| 3         | CONTRACT GUIDANCE DWGS                     |
| E.2       | VENDOR DATA                                |
| 3         | GFE/GFI                                    |
| 4.3.2     | HULL STRUCTURE                             |
| 4.3.1.2   | C&A DRAWINGS                               |
| 4.5.2     | ELEX SYSTEM DRAWINGS                       |
| 4.9       | SHIP SYSTEM DRAWINGS                       |
| 4.3       |  |
| 4.4       |  |
| 4.7       |  |
| 4.3.2.1.5 | MAST STRUCTURE                             |
| 4.5.4     | PRELIMINARY ELECTRICAL/ELECTRONICS STUDIES |
| 4.5.5     | WIREWAY SIZING AND ROUTING                 |

PROCESS

|    |  |
|----|--|
| 1. | ARRANGE MAJOR ELECTRONIC SPACES            |
| 2. | ARRANGE ANTENNA EQUIPMENT                  |
| 3. | ARRANGE RUNNING LIGHTS                     |
| 4. | DEVELOP ELECTRICAL COMPOSITE DECK DRAWINGS |

OUTPUT

|                      |       |
|----------------------|-------|
| ARRANGEMENT DRAWINGS | 4.2   |
|                      | 4.3   |
|                      | 4.4   |
|                      | 4.7   |
|                      | 4.5.5 |
|                      | 4.8   |
|                      | 4.5.2 |
|                      | E.1   |
|                      | 5.5   |
|                      | 4.5.8 |
|                      | 4.7.3 |
|                      | 4.5.3 |

TO: 4.5.1.1 THRU 4.5.1.4

BOX: 4.5.1

TITLE: ARRANGEMENTS

FROM: 4.5.1 ARRANGEMENTS

| INPUT  | PROCESS  | OUTPUT   |
|--|--|--|
| <p>4.3.1.2<br/>3<br/>3<br/>4.5.2.3<br/><br/>4.2<br/>4.3<br/>4.4.2<br/>4.7<br/><br/>4.3.2<br/>E.2<br/>3<br/>4.5.2.7<br/>4.5.4.1<br/>4.4.3<br/>4.5.5.2</p> <p>C&amp;A DRAWINGS<br/>CONTRACT SPECS<br/>CONTRACT GUIDANCE<br/>ELEX SYS DRAWINGS<br/><br/>SHIP SYSTEM DWGS<br/><br/>HULL STRUCTURE<br/>VENDOR DATA<br/>GFE/GFI<br/>DESIGN DIV INSTRS<br/>PREL. CABLEWAY LAYOUT<br/>PIPING ARR DRAWINGS<br/>WIREWAY DRAWINGS</p> | <p>1. REVIEW C&amp;A PLAN FOR SPACE AVAIL.<br/><br/>2. REVIEW L/M<br/><br/>3. REVIEW OPERATIONAL REQMTS FOR LOCATION<br/><br/>4. REVIEW COMPONENT DWGS FOR CLEARANCE AND ACCESS REQUIREMENTS, DIMENSIONS, ETC.<br/><br/>5. REVIEW CONTRACT GUIDANCE DWG/MOCK-UP<br/><br/>6. ANALYZE FOR INTERFERENCE</p> | <p>ELEX. SPACE ARR DWGS<br/><br/>HVAC REQMTS<br/><br/>FOUNDATION REQMTS</p> <p>E.1.5<br/>4.2.4.3<br/>4.4.4.7<br/>4.8<br/>4.5.2.3<br/><br/>4.7.3.1<br/><br/>4.3.2.2<br/>4.4.2<br/>4.5.5.2<br/>4.5.5.4<br/>4.5.5.3<br/>4.5.5.8<br/>4.2.3.1<br/>4.5.1.4<br/>4.5.8.2<br/>4.5.3.8</p> |

TO: NONE

BOX: 4.5.1.1

TITLE: ARRANGEMENTS OF MAJOR ELECTRONICS SPACES

FROM: 4.5.1 ARRANGEMENTS

OUTPUT

|                  |  |
|------------------|--|
| ANTENNA ARR DWGS | E.1<br>5<br>4.3.2.1.5<br>4.7<br>4.8<br>4.5.8.2 |
|------------------|--|

PROCESS

|  |
|--|
| 1. REVIEW L/M                                      |
| 2. REVIEW CONTRACT GUIDANCE<br>DRAWINGS            |
| 3. COORDINATE WITH HULL FOR<br>STRUCTURAL ANALYSIS |
| 4. REVIEW EMI REQUIREMENTS                         |

INPUT

|           |  |
|-----------|--|
| 3         | CONTRACT SPECS                           |
| 3         | CONTRACT GUIDANCE<br>DRAWINGS            |
| E.2       | VENDOR DATA                              |
| 3         | GFE/GFI (ANTENNA<br>MODEL STUDIES, ETC.) |
| 4.3.2.1.2 | DECK HOUSE STRUCTURE                     |
| 4.3.2.1.5 | MAST DESIGN                              |

TO: NONE

BOX: 4.5.1.2

TITLE: ANTENNA ARRANGEMENTS

FROM: 4.5.1 ARRANGEMENTS

| INPUT  | PROCESS  | OUTPUT   |
|--|--|--|
| <div>E.4</div> <div>4.3.2</div> <div>4.3.2.1.5</div> | <div>1. REVIEW USCG GFI</div> <div>2. OPTIMIZE LOCATION OF ALL LIGHTS/OBTAIN WAIVERS</div> | <div>RUNNING LIGHT ARR</div> <div>POWER REQMTS</div> <div>5</div> <div>E.4</div> <div>E.1</div> <div>4.3.2.1</div> <div>4.8</div> <div>4.5.2.3</div> |

TO: NONE

BOX: 4.5.1.3

TITLE: RUNNING LIGHTS ARRANGEMENT

FROM: 4.5.1 ARRANGEMENTS

INPUT

|         |                                |
|---------|--------------------------------|
| 4.5.2.3 | ISOMETRIC DWGS                 |
| 4.5.1.1 | ARR OF MAJOR ELECTRICAL SPACES |
| 4.3.1.2 | C&A PLANS                      |
| 4.3.2   | HULL STRUCTURE                 |
| 4.8     | DESIGN INTEGRATION             |
| 4.5.5.3 | PWR SYS DECK PLANS             |
| 4.5.5.8 | LTC SYS DECK DWGS              |

PROCESS

|   |
|---|
| 1. REVIEW ALL ARR DWGS AND SYSTEM DWGS TO ESTABLISH LOCATION OF ALL ELEC/ELEX EQUIP ON EACH DECK OR SECTION OF A DECK |
|---|

OUTPUT

|                     |                 |
|---------------------|-----------------|
| DECK COMPOSITE DWGS | 4.8<br>E.1<br>5 |
|---------------------|-----------------|

TO: NONE

\*Note:  
This function not performed at all yards.

BOX: 4.5.1.4

TITLE: ELECTRICAL/ELECTRONICS COMPOSITE DECK PLANS\*

FROM: 4.5 ELXDAC

# OUTPUT

## PROCESS

## INPUT

|       |                          |   |                                    |       |
|-------|--------------------------|---|------------------------------------|-------|
| 3     | CONTRACT SPECS           | 1. DEVELOP SCHEMATIC DWGS               | SYS DRAWINGS AND LIST OF MATERIALS | E.1   |
| 3     | CONTRACT GUIDANCE DWGS   | 2. DEVELOP ELEMENTARY DWGS              |                                    | 5.5   |
| 3     | GFE/GFI                  | 3. DEVELOP ISOMETRIC DWGS AND L/M       |                                    | 4.2   |
| 3     | EQUIP LISTS (GFI)        | 4. DEVELOP HOOK-UP LISTS                |                                    | 4.3   |
| E.2   | VENDOR DATA              | 5. DEVELOP TELEPHONE DIRECTORY          |                                    | 4.4   |
| 4.5.1 | ARRANGEMENTS             | 6. DEVELOP STANDARD METHODS DWG         |                                    | 4.7   |
| 4.5.5 | WIREWAY SIZING & ROUTING | 7. DEVELOP DESIGN DIVISION INSTRUCTIONS |                                    | 4.8   |
| 4.5.3 | SYS ANALYSIS & CALCS     |   |                                    | 4.5.1 |
| 4.5.4 | PREL ELEC/ELEX STUDIES   |   |                                    | 4.5.3 |
| 4.3.1 | HULL SYS ENCR            |   |                                    | 4.5.5 |
| 4.4.2 | COMPOSITE DWGS           |   |                                    | 4.5.8 |
| 4.4.3 | ARR DWGS                 |   |                                    | 4.5.6 |
|       |                          |   |                                    | 4.5.7 |
|       |                          |   |                                    | E.3   |

TO: 4.5.2.1 THRU 4.5.2.7

BOX: 4.5.2

TITLE: SYSTEM DRAWINGS AND LIST OF MATERIAL



FROM: 4.5.2 SYSTEM DRAWINGS AND LIST OF MATERIAL

| INPUT   |                                   | PROCESS   | OUTPUT                                 |
|---------|-----------------------------------|---|--|
| 3       | CONTRACT SPECS<br>& GUIDANCE DWGS | 1. DESIGNATE LOCATIONS (I.E.<br>COMPARTMENTS) BY AREAS ON<br>THE SCHEMATIC<br><br>2. PLACE BOXES REPR EQUIPMENT<br>WITHIN DESIGNATED AREAS<br><br>3. SHOW (WITH ONE-LINE CON-<br>NECTIONS OR CABLES) THE<br>FLOW OF SIGNALS BETWEEN<br>EQUIP<br><br>4. LABEL CONNECTIONS (WHEN<br>NECESSARY) WITH SIGNALS<br><br>5. SHOW INPUT/OUTPUT TO<br>OTHER SYSTEMS | ONE-LINE DIAGRAMS OR<br>BLOCK DIAGRAMS |
| 3       | GFE/GFI                           |   | E.1                                    |
| E.2     | VENDORS                           |   | 4.5.2.2                                |
| 3       | EQUIP LIST (GFI)                  |   | 4.5.2.3                                |
| 4.5.3.4 | SIZING OF COMPONENTS              |   | 4.5.5.7                                |
| 4.5.4.5 | PREL SYSTEM SKETCHES              |   | 4.5.2.4                                |
|         |                                   |   | 4.5.8.3                                |
|         |                                   |   | 5                                      |
|         |                                   |   | 4.5.3.3                                |
|         |                                   |   | 4.5.3.5                                |
|         |                                   |   | 4.5.6                                  |

TO: NONE

BOX: 4.5.2.1

TITLE: SCHEMATIC DRAWINGS

FROM: 4.5.2 SYSTEM DRAWINGS AND LIST OF MATERIAL

INPUT

PROCESS

OUTPUT

|         |                                   |
|---------|-----------------------------------|
| 3       | CONTRACT SPECS<br>& GUIDANCE DWGS |
| 3       | GFE/GFI                           |
| 3       | EQUIP LIST (GFI)                  |
| E.2     | VENDORS                           |
| 4.5.3.4 | SIZING OF COMPONENTS              |
| 4.5.4.5 | PREL SYSTEM SKETCHES              |
| 4.5.2.1 | SCHEM DWGS                        |
| 4.5.5.7 | EMI/GROUNDING REQMTS              |

|   |
|---|
| 1. DESIGNATE LOCATIONS (I.E.<br>COMPARTMENTS) WHERE EQUIP<br>IS TO BE INSTALLED |
| 2. SHOW DETAILS OF CONNECTION<br>DATA (AT THE WIRE LEVEL)                       |
| 3. LABEL ALL CONNECTIONS  |
| 4. SHOW SWITCHING REQMTS  |
| 5. SHOW SHIELD/GND REQMTS   |
| 6. SHOW FUSE REQMTS   |

|                      |   |
|----------------------|---|
| ELEM WIRING DIAGRAMS | E.1<br>5<br>4.5.2.4<br>4.5.2.3<br>4.5.6<br>4.5.7.1<br>4.5.7.2<br>4.5.8.1<br>4.5.8.3<br><br>4.5.3.3<br>4.5.3.5<br>4.5.3.1<br>4.5.3.2 |
|----------------------|---|

TO: NONE

BOX: 4.5.2.2

TITLE: ELEMENTARY DRAWINGS

FROM: 4.5.2 SYSTEM DRAWINGS AND LIST OF MATERIAL

OUTPUT

PROCESS

INPUT

| 3       | CONTRACT SPECS & GUIDANCE<br>DWGS                                     | 3       |
|---------|---|---------|
| 3       | CPE/GPI<br>EQUIP LIST (CPI)   | 3       |
| E.2     | VENDORS   | E.2     |
| 4.5.3.4 | SIZING OF COMPONENTS  | 4.5.3.4 |
| 4.5.2.2 | ELEMENTARY DWG  | 4.5.2.2 |
| 4.5.1.1 | ARRANGEMENTS OF MAJOR<br>ELEX SPACES                                  | 4.5.1.1 |
| 4.5.1.3 | RUNNING LIGHTS ARRANGEMENT  | 4.5.1.3 |
| 4.5.2.1 | SCHEMATIC DWGS  | 4.5.2.1 |
| 4.5.4.5 | PREL SYSTEM SKETCHES  | 4.5.4.5 |
| 4.5.4.3 | PREL EQUIP SELECTION<br>AND LONG LEAD TIME LIST                       | 4.5.4.3 |
| 4.3.1.2 | C&A PLANS   | 4.3.1.2 |
| 4.5.2.3 | ISOMETRIC DWGS (OTHER SYS)  | 4.5.2.3 |
| 4.5.2.7 | DESIGN DIV INSTR  | 4.5.2.7 |
| 4.5.4.1 | PREL CABLEWAY LAYOUTS   | 4.5.4.1 |
| 4.5.5.7 | EMI/GND REQTS   | 4.5.5.7 |
| 4.4.2   | COMPOSITE DWGS  | 4.4.2   |
| 4.4.3   | ARR DWGS  | 4.4.3   |
| 1.      | PREPARE ISOMETRIC DWGS FOR ELEC/<br>ELEX SYSTEMS                      | E.1     |
| 2.      | PREPARE LIST OF MATERIALS FOR<br>ASSOCIATED ISOMETRICS                | 5       |
| 3.      | SELECT DESIRABLE RUNS FOR CABLES                                      | 4.2.4   |
| 4.      | SELECT CABLE NO.'S, TYPES, AND<br>DETERMINE CABLE SEPARATION<br>REQTS | 4.3.1.3 |
| 5.      | SELECT APPROPRIATE CONNECTORS<br>AND DETERMINE TERMINAL BOX<br>REQTS  | 4.4.1   |
| 6.      | LABEL CABLES WITH WIRE NUM-<br>BERS (WHEN APPLICABLE)                 | 4.7.3.1 |
| 7.      | PERFORM WEIGHT & MOMENT<br>CALCULATIONS (AT SOME YARDS)               | 4.8     |
|         |   | E.3.1   |
|         |   | E.3.2   |
|         |   | 4.5.2.4 |
|         |   | 4.5.1.4 |
|         |   | 4.5.6   |
|         |   | 4.5.7.1 |
|         |   | 4.5.7.2 |
|         |   | 4.5.8.1 |
|         |   | 4.5.8.3 |
|         |   | 4.5.5.2 |
|         |   | 4.5.5.3 |
|         |   | 4.5.1.1 |
|         |   | 4.5.5.8 |
|         |   | 4.5.2.5 |
|         |   | 4.5.3.1 |
|         |   | 4.5.3.8 |
|         |   | 4.5.2.3 |

TO: NONE

BOX: 4.5.2.3

TITLE: ISOMETRIC DRAWINGS AND L/M

FROM: 4.5.2 SYSTEM DRAWINGS AND LIST OF MATERIAL

PROCESS

INPUT

| INPUT   |                                | PROCESS                  |  | OUTPUT        |                              |
|---------|--------------------------------|--------------------------|--|---------------|------------------------------|
| 3       | CONTRACT SPECS & GUIDANCE DWGS | 1. PREPARE HOOK-UP LISTS | 2. DETERMINE PIN-TO-PIN, PIN-TO-TERMINAL BOARD AND TERMINAL BOARD-TO PIN HOOK-UP REQMTS<br><br>3. SHOW UNIT-TO-UNIT CONNECTIONS & WIRE NUMBERS<br><br>4. SHOW PROPER CABLE TYPES, DESIGNATIONS AND CABLE SEPARATION REQMTS<br><br>5. PROVIDE COLOR CODE INFO | HOOK-UP LISTS | E.1<br>5<br>4.5.6<br>4.5.2.5 |
| 3       | GFE/GFI                        |                          |  |               |                              |
| 3       | EQUIP LISTS (GFI)              |                          |  |               |                              |
| E.2     | VENDORS                        |                          |  |               |                              |
| 4.5.2.2 | ELEMENTARY DWGS                |                          |  |               |                              |
| 4.5.2.1 | SCHEMATIC DWGS                 |                          |  |               |                              |
| 4.5.2.3 | ISOMETRIC DWGS & L/M           |                          |  |               |                              |
| 4.5.2.7 | DESIGN DIV INSTR               |                          |  |               |                              |
| 4.5.5.7 | EMI/GND REQMTS                 |                          |  |               |                              |

TO: NONE

BOX: 4.5.2.4

TITLE: HOOK-UP LISTS

## OUTPUT

## PROCESS

## INPUT

|         |                                   |   |                     |                |
|---------|-----------------------------------|---|---------------------|----------------|
| 3       | CONTRACT SPECS &<br>GUIDANCE DWGS | 1. PREPARE TELEPHONE DIRECTORY<br><br>2. ASSIGN CALL STATION NUMBERS<br>TO ALL APPROPRIATE TELE-<br>PHONES<br><br>3. ASSIGN PARTY LINES/HUNT<br>NOT BUSY WHERE APPLICABLE | TELEPHONE DIRECTORY | E.1<br>4.5.8.3 |
| 4.5.2.3 | ISOMETRIC DWGS & L/M              |   |                     |                |
| 4.5.2.4 | HOOK-UP LIST                      |   |                     |                |
| 4.5.2.7 | DESIGN DIV INSTR                  |   |                     |                |

**TO: NONE**

**BOX: 4.5.2.5**

**TITLE: TELEPHONE DIRECTORY**

FROM: 4.5.2 SYSTEM DRAWINGS AND LIST OF MATERIAL

OUTPUT

|          |                       |
|----------|-----------------------|
| E.1<br>5 | STANDARD METHODS DWGS |
|----------|-----------------------|

PROCESS

|   |
|---|
| 1. DEVELOP STANDARD METHODS TO<br>SHOW GROUNDING TECHNIQUES,<br>CABLE PREPARATION, END-<br>SEALING OF CABLES, TIEING<br>BACK SPARE CONDUCTORS, ETC. |
|---|

INPUT

|         |                                   |
|---------|-----------------------------------|
| 3       | CONTRACT SPECS &<br>GUIDANCE DWGS |
| E.2     | VENDORS                           |
| 4.5.5.7 | EMI/GND REQMTS                    |

TO: NONE

BOX: 4.5.2.6

TITLE: STANDARD METHODS DRAWINGS

FROM: 4.5.2 SYSTEM DRAWINGS AND LIST OF MATERIAL

INPUT

|       |                                   |
|-------|-----------------------------------|
| 3     | CONTRACT SPECS &<br>GUIDANCE DWGS |
| E.2   | VENDORS                           |
| E.1.4 | CHANGE ORDERS                     |

PROCESS

|   |
|---|
| 1. DEVELOP DESIGN DIVISION<br>INSTRUCTIONS FOR SHOPS/<br>TRADES WHERE CHANGES CAN<br>BEST BE ACCOMPLISHED VIA<br>INSTR AND SKETCHES RATHER<br>THAN PLAN REVISIONS |
|---|

OUTPUT

|                                 |   |
|---------------------------------|---|
| DESIGN DIVISION<br>INSTRUCTIONS | E.1<br>5<br>4.2.4<br>4.3.1.3<br>4.4.1<br>4.5.2.4<br>4.5.2.5<br>4.5.1.1<br>4.5.3.1<br>THRU<br>4.5.3.8<br>4.5.5.2<br>4.5.5.3<br>4.5.5.6<br>4.5.5.7<br>4.5.2.3<br>4.8<br>4.7.3.1 |
|---------------------------------|---|

TO: NONE

BOX: 4.5.2.7

TITLE: DESIGN DIVISION INSTRUCTIONS

FROM: 4.5 ELXDAC

INPUT

PROCESS

OUTPUT

|       |  |                 |
|-------|--|-----------------|
| 3     | CONTRACT SPECS   |                 |
| E.1.5 | GFE/GFI  |                 |
| E.2   | VENDOR DATA  |                 |
| 4.5.1 | ARRANGEMENTS   |                 |
| 4.5.2 | DWGS/L/M   |                 |
| 4.5.3 | SYS ANALYSIS CALC  |                 |
| 4.5.4 | PREL ELEC/ELEX STUDIES   |                 |
| 4.5.5 | WIREWAY SIZE & ROUTES  |                 |
|       | 1. PERFORM FAULT CURRENT, VOLTAGE DROP OR OTHER ANALYSIS AS REQUIRED BY SYSTEM | ANALYSIS & CALC |
|       |  | E.1             |
|       |  | 4.4             |
|       |  | 4.5.2           |
|       |  | 4.5.3           |
|       |  | 4.5.6           |
|       |  | 4.5.7           |
|       |  | 4.5.8           |
|       |  | 4.7             |
|       |  | 4.8             |
|       |  | 4.5.5           |

TO: NONE

BOX: 4.5.3

TITLE: SYSTEMS ANALYSIS AND CALCULATIONS



# FROM: 4.5.3 SYSTEMS ANALYSIS AND CALCULATIONS

## INPUT

|         |                        |
|---------|------------------------|
| 3       | CNTR'T SPECS GUID DWGS |
| 3       | SHIP'S SPECS           |
| 3       | GFE/GFI                |
| 3       | EQUIP LISTS (GFI)      |
| E.2     | VENDOR DATA            |
| 4.5.2.2 | ELEMENTARY DWGS        |
| 4.5.2.3 | ISOMETRIC DWGS         |
| 4.5.4.4 | PREL FAULT CURRENT     |
| 4.5.5.3 | PWR SYS DECK PLANS     |
| 4.5.5.8 | LTC SYS DECK PLANS     |
| 4.5.2.7 | DES DIV INSTR          |

## PROCESS

|  |
|--|
| 1. PERFORM FAULT CURRENT ANALYSIS USING THE POWER SYSTEM ELEM WIRING DIAGRAM, KNOWN CHARACTERISTICS OF THE SSGs, ESTIMATED CHARACTERISTICS OF THE OPERATING MOTORS, FEEDERS, BUS TIES AND CIRCUIT BREAKERS |
| DDS-? IS USED TO CALCULATE FAULT CURRENT.  |

## OUTPUT

|                        |         |
|------------------------|---------|
| FAULT CURRENT ANALYSIS | 4.5.3.4 |
|------------------------|---------|

TO: NONE

BOX: 4.5.3.1

TITLE: FAULT CURRENT

# FROM: 4.5.3 SYSTEMS ANALYSIS AND CALCULATIONS

INPUT

PROCESS

OUTPUT

|         |                         |   |                       |         |
|---------|-------------------------|---|-----------------------|---------|
| 3       | CNTR'T SPECS, GUID DWGS | <p>1. PERFORM VOLTAGE DROP BASED UPON CABLE LENGTH &amp; IMPEDANCE ALONG WITH SYSTEM VOLTAGE LEVEL.</p> <p>DDS-9620-2 IS USED TO PERFORM VOLTAGE DROP CALCULATIONS.</p> | VOLTAGE DROP ANALYSIS | 4.5.3.4 |
| 3       | SHIP'S SPECS            |   |                       |         |
| E.1.5   | GFE/GFI                 |   |                       |         |
| E.1.5   | EQUIP LISTS (GFI)       |   |                       |         |
| E.2     | VENDOR DATA             |   |                       |         |
| 4.5.2.2 | ELEM DWGS               |   |                       |         |
| 4.5.2.3 | ISOMETRIC DWGS          |   |                       |         |
| 4.5.4.4 | PREL VOLTAGE DROP       |   |                       |         |
| 4.5.5.3 | PWR SYS DECK PLANS      |   |                       |         |
| 4.5.5.8 | LTG SYS DECK PLANS      |   |                       |         |
| 4.5.2.7 | DES DIV INSTR           |   |                       |         |

TO: NONE

BOX: 4.5.3.2

TITLE: VOLTAGE DROPS

FROM: 4.5.3 SYSTEMS ANALYSIS AND CALCULATIONS

OUTPUT

|         |                       |
|---------|-----------------------|
| 4.5.3.4 | SYNCHRO LOAD ANALYSIS |
|---------|-----------------------|

PROCESS

|   |
|---|
| 1. DETERMINE THE QUANTITY OF SYNCHRO SIGNED AMPLIFIERS REQUIRED TO SUPPORT CONTROL & TORQUE SYNCHRO LOADS |
| NAVSEC DWG 815-1853311 & DDS-9650-2 ARE USED FOR THIS ANALYSIS.   |

INPUT

|         |                                |
|---------|--------------------------------|
| 3       | CONTRACT SPECS & GUIDANCE DWGS |
| 3       | SHIP'S SPEC                    |
| E.1.5   | GFE/GFI                        |
| E.2     | VENDOR DATA                    |
| 4.5.2.1 | SCHEM DIAGRAMS                 |
| 4.5.2.2 | ELEM WIRING DIAGRAMS           |
| 4.5.2.3 | ISOMETRIC DWGS                 |
| 4.5.2.7 | DESIGN DIVISION INSTR          |

TO: NONE

BOX: 4.5.3.3

TITLE: SYNCHRO LOADS

# FROM: 4.5.3 SYSTEMS ANALYSIS AND CALCULATIONS

## INPUT

|         |                       |
|---------|-----------------------|
| 3       | CONTRACT SPECS        |
| E.1.5   | GFE/GFI               |
| E.2     | VENDORS               |
| 4.5.3.1 | FAULT CURRENT         |
| 4.5.3.2 | VOLTAGE DROP          |
| 4.5.3.3 | SYNCHRO LOADS         |
| 4.5.3.5 | LOAD BALANCING        |
|         | SUMMARIES             |
| 4.5.2.3 | ISOMETRIC DWGS        |
| 4.5.2.7 | DESIGN DIVISION INSTR |

## PROCESS

|   |
|---|
| 1. DETERMINE PROPER SIZE/TYPE/<br>RATING OF COMPONENTS AND<br>CABLES BASED ON ANALYSIS<br>AND SPECIFICATION REQMTS.<br><br>TYPICAL COMPONENTS INCLUDE<br>TRANSFORMERS, MG SETS,<br>AMPLIFIERS, FUSES, CIRCUIT<br>BREAKERS, SWITCHES, ETC.<br>DDS-9610-3 IS USED FOR<br>VOLTAGE DIP CALCULATION.<br>DDS-9620-5 IS USED FOR<br>CABLE SIZING.<br>DDS-9620-4 IS USED FOR<br>SIZING, PROTECTIVE DEVICES. |
|---|

## OUTPUT

|                                |   |
|--------------------------------|---|
| SIZE OF COMPONENTS &<br>CABLES | 4.5.2.1<br>4.5.2.2<br>4.5.2.3<br>4.5.5.3<br>4.5.5.8<br>4.5.7.2<br>4.5.7.3 |
|--------------------------------|---|

TO: NONE

BOX: 4.5.3.4

TITLE: SIZING OF COMPONENTS

FROM: 4.5.3 SYSTEMS ANALYSIS AND CALCULATIONS

INPUT

|         |                         |
|---------|-------------------------|
| 3       | CONTRACT SPECS          |
| E.1.5   | GFE/GFI                 |
| E.2     | VENDORS                 |
| 4.5.2.1 | SCHEM DIAGRAM           |
| 4.5.2.2 | ELEM DIAGRAM            |
| 4.5.2.3 | ISOMETRIC DRAWINGS      |
| 4.5.4.4 | PREL LOAD SUMMARIES     |
| 4.5.5.3 | POWER SYSTEM DECK PLANS |
| 4.5.5.8 | LIGHTING SYS DECK PLANS |
| 4.5.2.7 | DESIGN DIVISION INSTR   |

PROCESS

|   |
|---|
| 1. TABULATE AND DISTRIBUTE LOADS EVENLY ON EACH OF THE THREE PHASES OF THE POWER, LIGHTING, AND I.C. CIRCUITS |
|---|

OUTPUT

|                        |                    |
|------------------------|--------------------|
| SYSTEM LOADS (3 PHASE) | 4.5.3.6<br>4.5.3.4 |
|------------------------|--------------------|

TO: NONE

BOX: 4.5.3.5

TITLE: LOAD BALANCING SUMMARIES

FROM: 4.5.3 SYSTEMS ANALYSIS AND CALCULATIONS

INPUT

|         |                       |
|---------|-----------------------|
| 3       | CONTRACT SPECS        |
| 4.5.3.5 | LOAD SUMMARIES        |
| 4.5.2.3 | ISOMETRIC DWGS        |
| 4.5.2.7 | DESIGN DIVISION INSTR |

PROCESS

|   |
|---|
| 1. THE SEQUENCING OF EQUIPMENT SHUTDOWN IS DETERMINED IN ORDER TO MINIMIZE LOADS DURING CASUALTY CONDITIONS |
|---|

OUTPUT

|                       |                           |
|-----------------------|---------------------------|
| SHUT-DOWN INSTRUCTION | 4.5.8.4<br>4.5.8.3<br>E.1 |
|-----------------------|---------------------------|

TO: NONE

BOX: 4.5.3.6

TITLE: LOAD SHEDDING

FROM: 4.5.3 SYSTEMS ANALYSIS AND CALCULATIONS

| INPUT   |                        | PROCESS  | OUTPUT                  |
|---------|------------------------|--|-------------------------|
| 3       | CONTRACT SPECS         | 1. PREPARE DECK DWGS INDICATING THE LOCATIONS IN EACH COM-PARTMENT THAT FOOT-CANDLE ILLUMINATION LEVEL READINGS ARE TO BE OBTAINED | ILLUMINATION SURVEY DWG |
| 4.5.5.8 | LIGHTING SYS DECK DWGS |  |                         |
| E.2     | VENDORS                |  |                         |
| 4.5.2.3 | ISOMETRIC DWGS         |  |                         |
| 4.5.2.7 | DESIGN DIVISION INSTR  |  | E.1<br>4.5.6<br>4.8     |

TO: NONE

BOX: 4.5.3.7

TITLE: LIGHTING SURVEYS

FROM: 4.5.3 SYSTEMS ANALYSIS AND CALCULATIONS

| INPUT   |                                | PROCESS   | OUTPUT      |                  |
|---------|--------------------------------|---|-------------|------------------|
| 3       | CONTRACT SPECS                 | 1. DETERMINE COOLING/HEATING/<br>DRY AIR REQMTS for ELEX<br>EQUIPMENT AND PROVIDE INFO<br>TO APPROPRIATE DISCIPLINE | HVAC REQMTS | 4.7.3.1<br>4.4.1 |
| E.1.5   | GFE/GFI                        |   |             |                  |
| E.2     | VENDORS                        |   |             |                  |
| 4.5.4.6 | PREL HVAC STUDIES              |   |             |                  |
| 4.5.1.1 | ARRANGEMENTS OF ELEX<br>SPACES |   |             |                  |
| 4.5.2.3 | ISOMETRIC DWGS                 |   |             |                  |
| 4.5.2.9 | DESIGN DIVISION INSTR          |   |             |                  |

TO: NONE

BOX: 4.5.3.8

TITLE: HVAC ANALYSIS



FROM: 4.5.3 SYSTEMS ANALYSIS AND CALCULATIONS

INPUT

|       |                    |
|-------|--------------------|
| 3     | CONTRACT SPECS     |
| E.1.5 | GFE/GFI            |
| E.2   | VENDORS            |
| 4.5.4 | OTHER PREL STUDIES |
| 4.3.1 | HULL SYS ENGR      |

PROCESS

|                                 |
|---------------------------------|
| 1. PERFORM INITIAL ENGR STUDIES |
|---------------------------------|

OUTPUT

|                   |       |
|-------------------|-------|
| INITIAL ENGR DATA | 4.3.1 |
|                   | 4.4.1 |
|                   | 4.5.3 |
|                   | 4.5.2 |
|                   | 4.5.4 |
|                   | 4.5.7 |
|                   | 4.5.1 |
|                   | 4.5.5 |
|                   | E.3.2 |
|                   | 4.7.2 |
|                   | 4.8   |

TO: 4.5.4.1 THRU 4.5.4.7

BOX: 4.5.4

TITLE: PERFORM PRELIMINARY ELECTRICAL/ELECTRONICS STUDIES

FROM: 4.5.4 PRELIMINARY ELEC/ELEX STUDIES

| INPUT   |                                   | PROCESS  | OUTPUT  |
|---------|-----------------------------------|--|---|
| 3       | CONTRACT SPECS<br>& GUIDANCE DWGS | 1. SELECT PREL LOCATION OF<br>MAIN CABLEWAY RUNS USING<br>CONTRACT SPECS, CONTRACT<br>OR CONTRACT GUIDANCE ARR<br>DWGS AND C&A PLANS | PREL CABLE RUN DWGS   |
| 4.3.1.2 | C&A PLANS                         |  |   |
| 4.5.4.2 | CABLE ESTIMATES                   |  |   |
| 4.5.4.4 | PREL ANALYSIS                     |  |   |
| 4.3.2   | HULL STRUCTURE                    |  | 4.5.5.2<br>4.5.2.3<br>4.5.5.3<br>4.5.5.8<br>4.5.1.1<br>4.8<br>4.5.4.7 |

TO: NONE

BOX: 4.5.4.1

TITLE: PRELIMINARY CABLEWAY LAYOUT

FROM: 4.5.4 PRELIMINARY ELEC/ELEX STUDIES

| INPUT   |  | PROCESS   | OUTPUT                      |
|---------|--|---|-----------------------------|
| 3       | CONTRACT SPECS<br>& CONTRACT DWGS                    | 1. ESTIMATE TOTAL SHIP REQMTS<br>FOR VARIOUS CABLE SIZES AND<br>TYPES FOR EARLY PROCUREMENT | CABLE ESTIMATES             |
| 4.5.4.5 | PREL SYS SKETCHES                                    |   |                             |
| E.1.5   | GFE/GFI  |   |                             |
| 4.5.4.4 | PREL LOAD SUMMARY,<br>FAULT CURRENT,<br>VOLTAGE DROP |   | E.3.2<br>4.5.4.4<br>4.5.4.1 |

TO: NONE

BOX: 4.5.4.2

TITLE: CABLE ESTIMATES

FROM: 4.5.4 PRELIMINARY ELEC/ELEX STUDIES

| INPUT   |                   | PROCESS   | OUTPUT   |
|---------|-------------------|---|--|
| 3       | CONTRACT SPECS    | 1. DETERMINE LONG LEAD TIME<br>ITEMS AND FORWARD TO PRO -<br>CUREMENT | PREL EQUIP LIST  |
| E.1.5   | GFE/GFI           |   |  |
| 4.5.4.5 | PREL SYS SKETCHES |   |  |
|         |                   |   | E.3.2<br>4.5.4.4<br>4.5.4.6<br>4.5.4.7<br>4.5.7.2<br>4.5.2.3 |

TO: NONE

BOX: 4.5.4.3

TITLE: PRELIMINARY EQUIPMENT SCHEDULE AND LONG LEAD TIME LIST

FROM: 4.5.4 PRELIMINARY ELEC/ELEX STUDIES

INPUT

|         |                      |
|---------|----------------------|
| 3       | CONTRACT SPECS       |
| E.1.5   | GFE/GFI              |
| 4.5.4.5 | PREL CABLE ESTIMATES |
| 4.5.4.3 | PREL EQUIP LISTS     |

PROCESS

|  |
|--|
| 1. PERFORM PREL ANALYSIS FOR<br>CABLE/CABLEWAY ESTIMATES |
|--|

OUTPUT

|               |   |
|---------------|---|
| PREL ANALYSIS | 4.5.3.1<br>4.5.3.2<br>4.5.3.5<br>4.5.4.2<br>4.5.4.1 |
|---------------|---|

TO: NONE

BOX: 4.5.4.4

TITLE: PRELIMINARY LOAD SUMMARY, FAULT CURRENT, VOLTAGE DROP

FROM: 4.5.4 PRELIMINARY ELEC/ELEX STUDIES

| INPUT |                           | PROCESS  | OUTPUT               |   |
|-------|---------------------------|--|----------------------|---|
| 3     | CONTRACT SPECS<br>GFE/GFI | 1. PREPARE HIGH LEVEL SYSTEM<br>SKETCHES SHOWING EQUIP<br>CONNECTIONS AND (WHEN<br>APPLICABLE) SWITCHING<br>REQMTS | PREL SYSTEM SKETCHES | 4.5.2.2<br>4.5.2.1<br>4.5.4.2<br>4.5.2.3<br>4.5.4.3 |

TO: NONE

BOX: 4.5.4.5

TITLE: PRELIMINARY SYSTEM SKETCHES

FROM: 4.5.4 PRELIMINARY ELEC/ELEX STUDIES

OUTPUT

|                  |                           |
|------------------|---------------------------|
| PREL HVAC REQMTS | 4.5.3.8<br>4.7.2<br>4.4.1 |
|------------------|---------------------------|

PROCESS

|   |
|---|
| 1. EXAMINE CONTRACT SPECS,<br>CONTRACT DWGS OF ARR AND<br>VENDOR'S TECH MANUALS<br>TO GIVE ROUGH HVAC AND<br>COOLING REQMTS |
|---|

INPUT

|         |                                      |
|---------|--------------------------------------|
| 3       | CONTRACT SPECS<br>AND CONTRACT PLANS |
| E.1.5   | GFE/GFI                              |
| E.2     | VENDORS                              |
| 4.5.4.3 | PREL EQUIP LIST                      |

TO: NONE

BOX: 4.5.4.6

TITLE: PRELIMINARY HVAC STUDIES

FROM: 4.5.4 PRELIMINARY ELEC/ELEX STUDIES

| INPUT   |                                      | PROCESS  | OUTPUT |         |
|---------|--------------------------------------|--|--------|---------|
| 3       | CONTRACT SPECS<br>AND CONTRACT PLANS | 1. PROVIDE INITIAL INFO TO<br>HULDAC RE: WEIGHTS AND<br>MOMENTS USING PREL INFO<br>ON EQUIP WEIGHTS AND<br>LOCATIONS |        |         |
| E.1.5   | GFE/GFI                              |  |        |         |
| E.2     | VENDORS                              |  |        |         |
| 4.5.4.3 | PREL EQUIP LIST                      |  |        |         |
| 4.5.4.1 | PREL CABLEWAY LAYOUTS                |  |        | 4.3.1.3 |

TO: NONE

BOX: 4.5.4.7

TITLE: PRELIMINARY WEIGHT AND MOMENT ESTIMATE



FROM: 4.5 ELXDAC

INPUT

PROCESS

OUTPUT

|       |                        |
|-------|------------------------|
| 3     | CONTRACT SPECS         |
| E.2   | VENDOR DATA            |
| E.1.5 | GFE/GFI                |
| 4.2.3 | MACH ARR DWGS          |
| 4.3.1 | HULL SYS ENGR          |
| 4.3.2 | HULL DETAIL DESIGN     |
| 4.5.1 | ELXDAC ARR             |
| 4.5.2 | ELXDAC DWGS & L/M      |
| 4.5.3 | ELXDAC SYS ANAL & CALC |
| 4.5.4 | ELXDAC PREL STUDIES    |
| 4.5.5 | ELXDAC WIREWAYS        |
| 4.8   | DESIGN INTEGRATION     |

|  |
|--|
| 1. USING PREL CABLEWAY LAYOUTS<br>ISOM DWGS, DECK PLANS &<br>CONTRACT GUIDANCE, PROVIDE<br>DETAILS OF CABLE ROUTES,<br>PENETRATIONS, AND CABLE<br>HANGER DETAILS. PROVIDE<br>INFO TO HULL STRUCTURES |
|--|

|                 |  |
|-----------------|--|
| WIREWAY DETAILS | E.1<br>E.3.2<br>4.3.2<br>4.4.1<br>4.5.1<br>4.5.2<br>4.5.3<br>4.5.5<br>4.5.6<br>4.5.8<br>4.8<br>5 |
|-----------------|--|

TO: 4.5.5.1 THRU 4.5.5.8

BOX: 4.5.5

TITLE: WIREWAY SIZING AND ROUTING

FROM: 4.5.5 WIREWAY SIZING AND ROUTING

| INPUT   |                                 | PROCESS   | OUTPUT               |
|---------|---------------------------------|---|----------------------|
| 3       | CONTRACT SPECS                  | 1. DETERMINE NUMBER & SIZE OF<br>CABLE TIERS. PREPARE CABLE<br>HANGER DETAILS | CABLE HANGER DETAILS |
| 4.5.5.2 | WIREWAY DWGS                    |   |                      |
| 4.3.2.1 | STRUCTURAL DETAIL<br>DESIGN     |   |                      |
| 4.5.5.6 | CABLE ROUTING &<br>PENETRATIONS |   |                      |
|         |                                 |   | 5<br>4.8             |

TO: NONE

BOX: 4.5.5.1

TITLE: CABLE HANGER DETAILS

FROM: 4.5.5 WIREWAY SIZING AND ROUTING

INPUT

|         |                          |
|---------|--------------------------|
| 3       | CONTRACT SPECS           |
| 4.3.1.2 | C&A PLANS                |
| 4.5.2.3 | ISOMETRIC DRAWINGS       |
| 4.5.5.7 | EMI/GRND/SEP REQMTS      |
| 4.5.5.3 | PWR SYS DECK PLANS       |
| 4.5.5.8 | LTC SYS DECK PLANS       |
| 4.5.4.1 | PREL CABLEWAY LAYOUTS    |
| 4.5.1.1 | ARR OF MAJOR ELEX SPACES |
| 4.8     | DESIGN INTEGRATION       |
| 4.5.5.5 | CABLE HEAT DISSIPATION   |
| 4.5.2.7 | DES DIV INSTR            |

PROCESS

|  |
|--|
| 1. PROVIDE LOCATIONS AND DIMENSIONS OF MAIN CABLEWAYS            |
| 2. PROVIDE PROPORTIONAL PLAN VIEWS AND INBOARD PROFILES          |
| 3. INDICATE TRANSITS USED FOR PENETRATION OF DECKS AND BULKHEADS |

OUTPUT

|                       |         |
|-----------------------|---------|
| MAIN CABLEWAY LAYOUTS | 5       |
|                       | 4.5.5.1 |
|                       | E.1     |
|                       | 4.8     |
|                       | 4.3.2.3 |
|                       | 4.5.1.1 |
|                       | 4.5.5.5 |
|                       | 4.5.5.6 |

TO: NONE

BOX: 4.5.5.2

TITLE: WIREWAY DRAWINGS

# FROM: 4.5.5 WIREWAY SIZING AND ROUTING

## INPUT

## PROCESS

## OUTPUT

|  |   |   |  |
|--|---|---|--|
| <p>3<br/>4.3.1.2<br/>4.5.2.3<br/>4.5.4.1<br/>E.2<br/>4.2.3.1<br/>4.5.3.4<br/>4.5.1.1.<br/>4.2.1.1.1<br/>THRU<br/>4.2.1.1.6<br/>4.2.1.2.1<br/>THRU<br/>4.2.1.2.5<br/>4.2.1.3<br/>THRU<br/>4.2.1.3.2<br/>4.7.2.1<br/>4.7.3.4<br/>4.7.4.1<br/>4.7.4.2<br/>4.7.5.1<br/>4.7.7.1<br/>4.5.2.7</p> | <p>CONTRACT SPECS<br/>C&amp;A PLANS<br/>ISOMETRIC DRAWINGS<br/>PREL CABLEWAY LAYOUTS<br/>VENDOR DATA<br/>MACHY ARR DWG<br/>SIZING OF COMPONENTS<br/>ARR OF MAJOR ELEX SPACES<br/>MACHY LISTS<br/><br/>AUX MACHY LISTS<br/><br/>SHIP'S SERVICE MACHY<br/><br/>PREL HVAC STUDIES<br/>HEATING ANALYSIS<br/>HVAC DIAGRAMMATIC &amp;<br/>EQUIP LIST<br/>FAN ROOM ARR<br/>HVAC ARR<br/>DESIGN DIV INSTR</p> | <p>1. PROVIDE DRAWINGS SHOWING POWER DISTRIBUTION FROM DISTRIBUTION PANELS TO THE USER EQUIPMENT (I.E., MOTORS, CONTROLLERS, AND RECEPTACLES). MANUAL AND AUTOMATIC CONTROL DEVICES ARE INDICATED INCLUDING ASSOCIATED WIRING</p> | <p>POWER SYSTEM DECK DRAWINGS</p> <p>5<br/>4.5.3.1<br/>4.5.3.2<br/>E.1<br/>4.5.5.2<br/>E.3.2<br/>4.5.8.1<br/>4.5.8.3<br/>4.5.1.4<br/>4.5.3.5</p> |
|--|---|---|--|

TO: NONE

BOX: 4.5.5.3

TITLE: POWER SYSTEM DECK PLANS

FROM: 4.5.5 WIREWAY SIZING AND ROUTING

INPUT

|         |                             |
|---------|-----------------------------|
| 3       | CONTRACT SPECS              |
| 4.3.1.2 | C&A PLANS                   |
| E.1.5   | GFE/GFI                     |
| E.2     | VENDOR'S DATA               |
| 4.5.1.1 | ARR OF MAJOR ELEX<br>SPACES |
| 4.8     | DESIGN INTEGRATION          |

PROCESS

|   |
|---|
| 1. PROVIDE FOR SIGNED PATHS<br>AS DESCRIBED ON THE MISSILE<br>SYSTEM, GUNNERY SYSTEM,<br>RADAR SYSTEM AND EW SYSTEM<br>DWGS |
| 2. PROCURE SPECIAL EQUIPMENT<br>REQMTS  |
| 3. PROVIDE INFO TO HULL ON<br>PENETRATION AND INFO TO<br>PIPING ON DRY AIR REQMTS   |

OUTPUT

|                        |   |
|------------------------|---|
| TRANSMISSION LINE DWGS | 5<br>E.1<br>4.4.1<br>4.3.2.3<br>4.8<br>4.5.6<br>4.5.8.3 |
|------------------------|---|

TO: NONE

BOX: 4.5.5.4

TITLE: WAVEGUIDE/TRANSMISSION LINE DRAWINGS

FROM: 4.5.5 WIREWAY SIZING AND ROUTING

INPUT

|         |                  |
|---------|------------------|
| 3       | CONTRACT SPECS   |
| 4.5.5.2 | WIREWAY DRAWINGS |
| E.2     | CABLE CATALOGS   |

PROCESS

|   |
|---|
| 1. DETERMINE THE EFFECTS OF CABLE HEATING WITHIN WIREWAYS. DE-RATING FACTORS FOR CABLES ARE USED. |
| 2. CABLE ROUTES AND/OR WIREWAYS MAY BE MODIFIED BASED ON RESULTS                                  |

OUTPUT

|                    |         |
|--------------------|---------|
| CABLE ROUTES/SIZES | 4.5.5.2 |
|--------------------|---------|

TO: NONE

BOX: 4.5.5.5

TITLE: CABLE HEATING DISSIPATION

FROM: 4.5.5 WIREWAY SIZING AND ROUTING

INPUT

|         |                        |
|---------|------------------------|
| 3       | CONTRACT SPECS         |
| 4.5.2.7 | DESIGN DIV INSTRUCTION |
| E.2     | CABLE CATALOGS         |
| 4.5.5.7 | EMI/CND/SEP REQMTS     |
| 4.5.5.2 | WIREWAY DWGS           |

PROCESS

|   |
|---|
| 1. IDENTIFY CABLE ROUTE NUMBERS AND PENETRATION NUMBERS       |
| 2. PROVIDE A REFERENCE TABLE OF TRANSIT ASSIGNMENTS TO CABLES |
| 3. PROVIDE SIZING OF TRANSITS FOR BULKHEAD PENETRATIONS       |

OUTPUT

|                                     |                                |
|-------------------------------------|--------------------------------|
| TRANSIT SIZES AND CABLE ASSIGNMENTS | 5<br>E.1<br>4.5.5.1<br>4.3.2.3 |
|-------------------------------------|--------------------------------|

TO: NONE

BOX: 4.5.5.6

TITLE: CABLE ROUTING AND PENETRATION DATA

FROM: 4.5.5 WIREWAY SIZING AND ROUTING

| INPUT   |                         | PROCESS   | OUTPUT  |
|---------|-------------------------|---|---|
| 3       | CONTRACT SPECS          | 1. DETERMINE SHIELDING/<br>SEPARATION REQMTS FOR LOW<br>LEVEL (SIGNAL CABLES)<br><br>2. DETERMINE PROPER BONDING<br>TECHNIQUES FOR GROUNDING<br>OF CABLE SHEATHS AND<br>EQUIPMENT | EMI/GROUNDING INSTR   |
| E.2     | VENDOR DATA             |   | 5   |
| 4.5.2.7 | DESIGN DIV INSTRUCTIONS |   | E.1<br>4.5.2.6<br>4.5.2.3<br>4.5.2.4<br>4.5.5.2<br>4.5.2.2<br>4.5.5.6 |

TO: NONE

BOX: 4.5.5.7

TITLE: EMI/GROUNDING REQUIREMENTS



FROM: 4.5.5 WIREWAY SIZING AND ROUTING

INPUT

|         |                             |
|---------|-----------------------------|
| 3       | CONTRACT SPECS              |
| 4.3.1.2 | C&A PLANS                   |
| E.2     | VENDOR'S DATA               |
| 4.2.3.1 | MACHY ARR DWG               |
| 4.5.1.1 | ARR OF MAJOR ELEX<br>SPACES |
| 4.5.3.4 | SIZING OF COMPONENTS        |
| 4.5.4.1 | PREL CABLEWAY LAYOUTS       |
| 4.5.2.3 | ISOMETRIC DRAWINGS          |

PROCESS

|   |
|---|
| 1. PROVIDE DRAWINGS SHOWING<br>LIGHTING DISTRIBUTION FROM<br>DISTRIBUTION PANELS TO<br>LIGHTING FIXTURES AND<br>APPLIANCES IN ACCORDANCE<br>WITH ARR DWGS |
|---|

OUTPUT

|                   |   |
|-------------------|---|
| LTC SYS DECK DWGS | 5<br>4.5.3.1<br>4.5.3.2<br>E.1<br>4.5.5.2<br>E.3.2<br>4.5.8.1<br>4.5.8.3<br>4.5.1.4<br>4.5.3.7<br>4.5.3.5 |
|-------------------|---|

TO: NONE

BOX: 4.5.5.8

TITLE: LIGHTING SYSTEM DECK PLANS

FROM: 4.5 ELXDAC

# INPUT

# PROCESS

# OUTPUT

|         |                                |
|---------|--------------------------------|
| 3       | CONTRACT SPECS & GUIDANCE DWGS |
| 3       | GFE/GFI                        |
| E.2     | VENDORS                        |
| 4.5.2.2 | ELEMENTARY DWGS                |
| 4.5.2.3 | ISOMETRIC DWGS & L/M           |
| 4.5.2.4 | HOOK-UP LISTS                  |
| 4.5.8.3 | SHIP'S INFO BOOK               |
| 4.5.8.4 | EQUIP OPERATOR INSTR           |
| 4.5.8.2 | WARNING/HAZARD SIGNS           |
| 4.5.5.4 | WAVEGUIDE/TRANS-               |
| 4.5.2.1 | MISSION LINE DWGS              |
| 4.5.3   | SCHEMATIC DWGS                 |
| 4.5.3.7 | SYSTEMS ANAL & CALCS           |
| 4.5.5   | LIGHTING SURVEYS               |
|         | WIREWAY SIZING & ROUTING       |

|                 |                                       |
|-----------------|---------------------------------------|
| TEST PROCEDURES | E.1<br>5<br>4.5.8<br>4.5.8.3<br>E.3.1 |
|-----------------|---------------------------------------|

|   |
|---|
| 1. DEVELOP TEST SPECIFICATION REQMTS AND TEST PROCEDURES FOR THE INSTALLATION, POWER-UP, OPERATIONAL INTEGRATION AND SEA TRIAL PHASES OF THE TEST PROGRAM |
|---|

TO: NONE

BOX: 4.5.6

TITLE: TEST PROCEDURES

FROM: 4.5 ELXDAG

INPUT

PROCESS

OUTPUT

|       |                                   |
|-------|-----------------------------------|
| 3     | CONTRACT SPECS &<br>GUIDANCE DWGS |
| 3     | SHIP SPECS                        |
| 3     | GFE/GFI                           |
| 3     | EQUIP LISTS (GFI)                 |
| E.2   | VENDOR DATA                       |
| 4.5.2 | DRAWINGS & L/M                    |
| 4.5.3 | SYSTEMS ANAL & CALC               |
| 4.5.4 | PREL ELEC/ELEX STUDIES            |

|  |
|--|
| 1. PREPARE PROCUREMENT SPECIFICATION FOR CONSOLES            |
| 2. PREPARE PROCUREMENT SPECIFICATION FOR IC/ACO SWITCH-BOARD |
| 3. PREPARE PROCUREMENT SPECIFICATION FOR POWER MG SETS       |

|                                    |
|------------------------------------|
| PROCUREMENT SPECIFICATIONS FOR CFE |
| E.3.2<br>4.5.8                     |

TO: 4.5.7.1 THRU 4.5.7.3

BOX: 4.5.7

TITLE: PROCUREMENT SPECIFICATIONS FOR CFE

FROM: 4.5.7 PROCUREMENT SPECIFICATIONS FOR CFE

| INPUT   |                    | PROCESS  | OUTPUT                                 |
|---------|--------------------|--|--|
| 3       | CONTRACT SPECS     | 1. REVIEW SHIP SPECIFICATIONS, CONTRACT SPECIFICATIONS AND GFI TO PREPARE PROCUREMENT SPECIFICATION FOR CONSOLES | PROCUREMENT SPECIFICATION FOR CONSOLES |
| 3       | SHIP SPECS         |  |  |
| 3       | GFI                |  |  |
| 4.5.2.3 | ISOMETRIC DRAWINGS |  |  |
| 4.5.2.2 |                    |  | E.3.2<br>4.5.8.1                       |

TO: NONE

BOX: 4.5.7.1

TITLE: CONSOLES

FROM: 4.5.7 PROCUREMENT SPECIFICATIONS FOR CFE

INPUT

PROCESS

OUTPUT

|         |   |
|---------|---|
| 3       | CONTRACT SPECS &<br>GUIDANCE DWGS       |
| 3       | SHIP SPECS                              |
| 3       | GFI                                     |
| 4.5.2.3 | ISOMETRIC DRAWINGS                      |
| 4.5.2.2 | ELEM W/D                                |
| 4.5.4.3 | PREL EQUIP SEL &<br>LONG LEAD TIME LIST |
| 4.5.3.4 | SIZING OF COMPONENTS                    |

|   |
|---|
| 1. REVIEW SHIP SPECIFICATIONS,<br>CONTRACT SPECIFICATIONS &<br>GUIDANCE DWGS, CFI AND<br>VENDOR DATA INCLUDING<br>ALARM, INDICATING, NAVI-<br>CATION AND IC VOICE SYSTEMS |
| 2. DESIGN AND LAYOUT SWITCH-<br>BOARD   |
| 3. USE OUTPUTS OF FUNCTION<br>4.5.3.4 TO SELECT FUSES,<br>INDICATORS, SWITCHES, ETC.  |

|  |                             |
|--|-----------------------------|
| PROCUREMENT SPECIFI-<br>CATION FOR IC/ACO<br>SWITCHBOARD | E.3.2<br>4.5.8.1<br>4.5.8.2 |
|--|-----------------------------|

TO: NONE

BOX: 4.5.7.2

TITLE: IC/ACO SWITCHBOARD

FROM: 4.5.7 PROCUREMENT SPECIFICATIONS FOR CFE

INPUT

|         |                                      |
|---------|--------------------------------------|
| 3       | CONTRACT SPECS AND GUIDANCE DRAWINGS |
| 3       | SHIP SPECIFICATIONS                  |
| 3       | GFE/GFI                              |
| E.2     | VENDOR DATA                          |
| 3       | EQUIP LISTS (GFI)                    |
| 4.5.3.4 | SIZING OF COMPONENTS                 |

PROCESS

|    |  |
|----|--|
| 1. | REVIEW CONTRACT SPECIFICATIONS AND GUIDANCE DRAWINGS, SHIP SPECIFICATIONS, GFI, VENDOR DATA AND EQUIP LISTS FOR ALL COMPONENTS USING POWER |
|    | USE FUNCTION 4.5.3.4 TO SELECT MG SETS   |

OUTPUT

|   |                  |
|---|------------------|
| PROCUREMENT SPECIFICATION FOR POWER MG SETS | E.3.2<br>4.5.8.1 |
|---|------------------|

TO: NONE

BOX: 4.5.7.3

TITLE: POWER MG SETS

FROM: 4.5 ELXDAC

INPUT

|       |  |
|-------|--|
| 3     | CONTRACT SPECS AND GUIDANCE DRAWINGS   |
| 3     | GFE/GFI                                |
| 3     | EQUIP LISTS (GFI)                      |
| E.2   | VENDOR DATA                            |
| 4.5.2 | DRAWINGS AND L/M                       |
| 4.5.1 | ARRANGEMENTS                           |
| 4.5.5 | WIREWAY SIZING AND ROUTING             |
| 4.5.7 | PROCUREMENT SPECS FOR CFE              |
| 4.5.8 | PREPARE OPERATIONAL DOCUMENTS (OTHERS) |
| 4.5.6 | TEST PROCEDURES                        |
| 4.5.3 | SYSTEMS ANAL & CALC                    |

PROCESS

|    |                                     |
|----|-------------------------------------|
| 1. | DEVELOP LABEL PLATE REQUIREMENTS    |
| 2. | DEVELOP WARNING/HAZARD SIGNS        |
| 3. | PREPARE SHIP'S INFO BOOK            |
| 4. | PREPARE EQUIP OPERATOR INSTRUCTIONS |

OUTPUT

|                       |       |
|-----------------------|-------|
| OPERATIONAL DOCUMENTS | E.1   |
| LABEL PLATES          | E.3   |
| WARNING/HAZARD SIGNS  | 5     |
|                       | 4.5.6 |
|                       | 4.5.8 |

TO: 4.5.8.1 THRU 4.5.8.4

BOX: 4.5.8

TITLE: PREPARE OPERATIONAL DOCUMENTS

FROM: 4.5.8 PREPARE OPERATIONAL DOCUMENTS

| INPUT   |                         | PROCESS   | OUTPUT   |
|---------|-------------------------|---|--|
| 3       | CONTRACT SPECS          | 1. SELECT COMPONENTS THAT REQUIRE LABELS                              | LABEL PLATES<br>INSCRIPTIONS<br>FORMAT<br>LISTS<br>MOUNTING INSTRUCTIONS |
| 4.5.2.2 | ELEMENTARY DRAWINGS     | 2. PREPARE TEXT FOR INDIVIDUAL COMPONENT LABEL PLATE                  |  |
| 4.5.2.3 | ISOMETRICS AND L/M      | 3. DETERMINE FORMAT   |  |
| 4.5.5.3 | POWER SYSTEM DECK PLANS | 4. IDENTIFY EACH LABEL BY UNIQUE NUMBER AND COMPARTMENT               |  |
| 4.5.5.8 | LIGHTING SYS DECK PLANS | 5. PREPARE LIST OF LABEL PLATES FOR EACH ELEX SYSTEM                  |  |
|         |                         | 6. PREPARE LIST OF LABEL PLATES FOR ALL ELEX SYSTEMS IN A COMPARTMENT | E.3.1<br>E.3.2<br>E.1<br>5   |
|         |                         | 7. PREPARE INSTRUCTIONS FOR MOUNTING                                  |  |

TO: NONE

BOX: 4.5.8.1

TITLE: LABEL PLATE REQUIREMENTS



FROM: 4.5.8 PREPARE OPERATIONAL DOCUMENTS

INPUT

|         |                                 |
|---------|---------------------------------|
| 3       | CONTRACT SPECS                  |
| 4.5.1.2 | ANTENNA ARR                     |
| 4.5.8.4 | EQUIPMENT OPERATOR INSTRUCTIONS |
| 4.5.7.2 | IC/ACO SWITCHBOARD              |
| 4.5.1.1 | ARR OF MAJOR ELEX SPACES        |

PROCESS

|  |
|--|
| 1. SELECT COMPONENTS THAT REQUIRE WARNING/HAZARD SIGNS       |
| 2. PREPARE TEXT FOR EACH INDIVIDUAL SIGN                     |
| 3. DETERMINE TEXT FORMAT                                     |
| 4. PREPARE LIST OF SIGNS FOR EACH ELEX SYSTEM                |
| 5. PREPARE LIST OF SIGNS FOR EACH COMPARTMENT                |
| 6. IDENTIFY EACH SIGN BY UNIQUE NUMBER/COMPONENT/COMPARTMENT |
| 7. PREPARE INSTRUCTIONS FOR MOUNTING                         |

OUTPUT

|   |  |
|---|--|
| WARNING/HAZARD SIGNS INSCRIPTIONS<br>FORMAT<br>LISTS<br>MOUNTING INSTRUCTIONS | E.3.1<br>E.3.2<br>E.1<br>5<br>4.5.8.3<br>4.5.6 |
|---|--|

TO: NONE

BOX: 4.5.8.2

TITLE: WARNING HAZARD SIGNS

FROM: 4.5.8 PREPARE OPERATIONAL DOCUMENTS

INPUT

PROCESS

OUTPUT

|         |                                    |   |                         |       |
|---------|------------------------------------|---|-------------------------|-------|
| 3       | CONTRACT SPECS & GUIDANCE DRAWINGS | 1. PREPARE TEXT FOR DESCRIPTION OF EACH ELECTRICAL/ELECTRONICS SYSTEM FOR SIB | SHIP'S INFORMATION BOOK | E.1   |
| 3       | GFE/GFI                            |   |                         | 5     |
| 3       | EQUIP LISTS (GFI)                  |   |                         | 4.5.6 |
| E.2     | VENDOR DATA                        | 2. PREPARE DRAWINGS FOR EACH ELECTRICAL/ELECTRONICS SYSTEM FOR SIB            |                         |       |
| 4.5.2.1 | SCHEMATIC DRAWINGS                 |   |                         |       |
| 4.5.2.2 | ELEMENTARY DRAWINGS                |   |                         |       |
| 4.5.2.3 | ISOMETRIC DRWGS & L/M              |   |                         |       |
| 4.5.5.3 | POWER SYS DECK PLANS               |   |                         |       |
| 4.5.5.4 | TRANSMISSION LINE DRAWINGS         |   |                         |       |
| 4.5.5.8 | LIGHTING SYSTEM DECK PLANS         |   |                         |       |
| 4.5.8.2 | WARNING/HAZARD SIGNS               |   |                         |       |
| 4.5.8.4 | EQUIPMENT OPERATOR INSTRUCTIONS    |   |                         |       |
| 4.5.2.5 | TELEPHONE DIRECTORY                |   |                         |       |
| 4.5.6   | TEST PROCEDURES                    |   |                         |       |
| 4.5.3.6 | LOAD SHEDDING                      |   |                         |       |

TO: NONE

BOX: 4.5.8.3

TITLE: SHIP'S INFORMATION BOOK

FROM: 4.5.8 PREPARE OPERATIONAL DOCUMENTS

| INPUT   |                  | PROCESS   | OUTPUT   |
|---------|------------------|---|--|
| 3       | CONTRACT SPECS & | <p>1. PREPARE TEXT FOR EQUIPMENT OPERATION INSTRUCTIONS FOR EACH ELECTRICAL/ELECTRONICS SYSTEM/COMPONENT</p> <p>2. PREPARE DRAWINGS FOR EQUIPMENT OPERATION INSTRUCTIONS FOR EACH ELECTRICAL/ELECTRONICS SYSTEM/COMPONENT</p> | <p>EQUIPMENT OPERATION INSTRUCTIONS</p>                        |
| 3       | GFE/GFI          |   |  |
| 3       | EQUIP LIST (GFI) |   |  |
| E.2     | VENDOR DATA      |   |  |
| 4.5.3.6 | LOAD SHEDDING    |   |  |
| 142     |                  |   | <p>E.1</p> <p>5</p> <p>4.5.6</p> <p>4.5.8.3</p> <p>4.5.8.2</p> |

TO: NONE

BOX: 4.5.8.4

TITLE: EQUIPMENT OPERATION INSTRUCTION

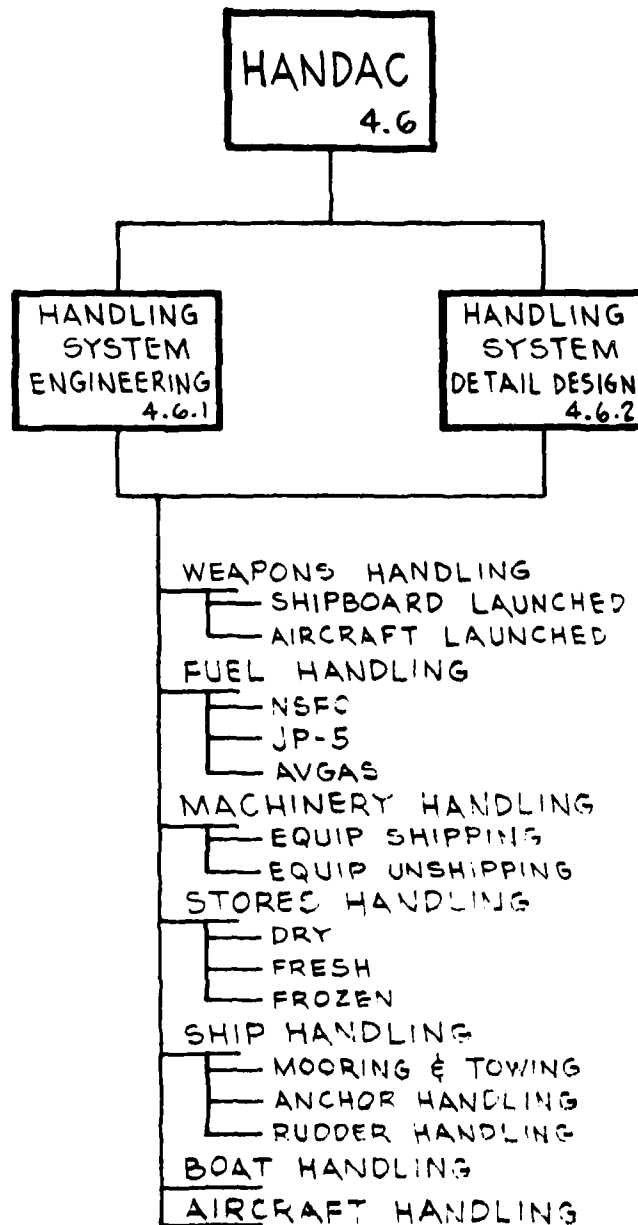
HANDAC 4.6

HIPO

DIAGRAMS

NOTE: No HIPO diagrams were  
developed for this section.

FROM: CASDAC LEVEL IV



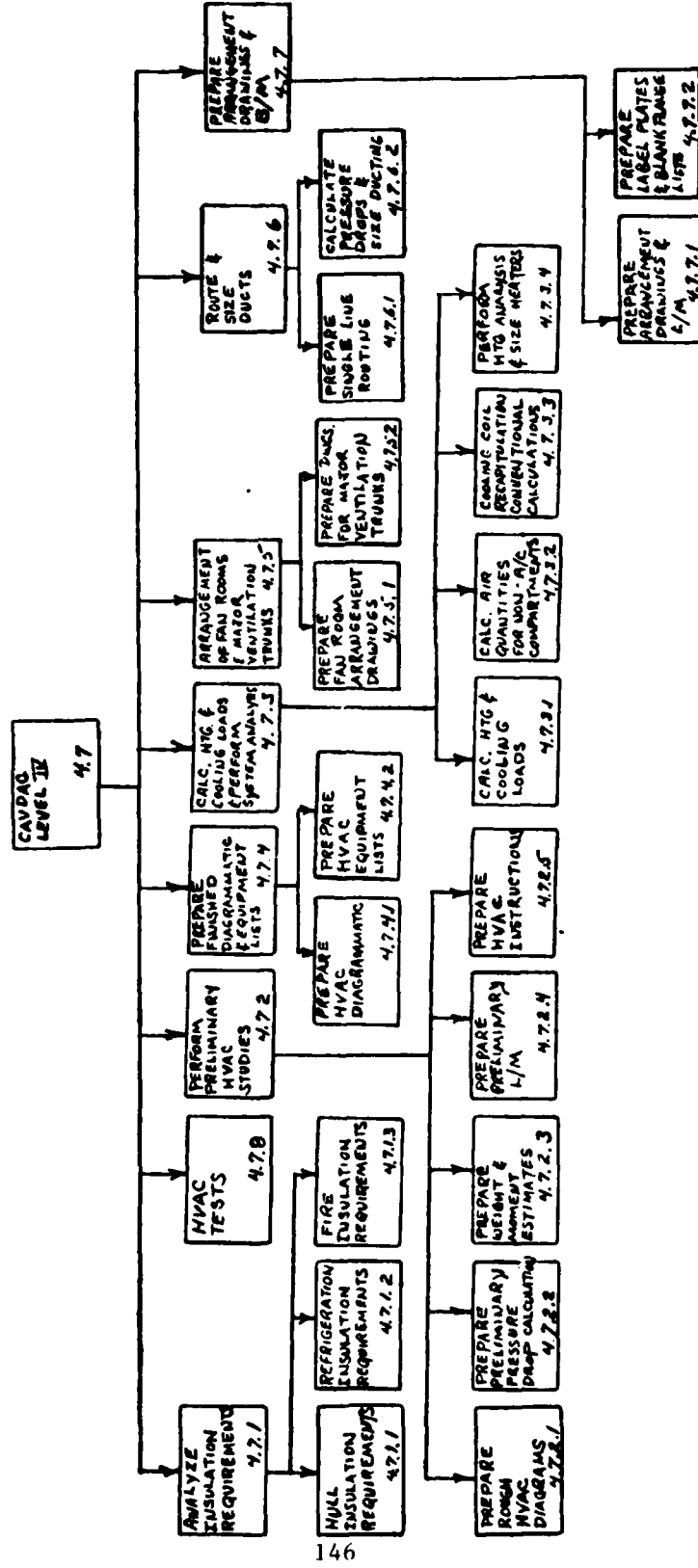
TITLE: HANDAC STRUCTURE

CAVDAC 4.7

HIPO

DIAGRAMS

FROM: CASDAC LEVEL IV



TITLE: CAVDAC STRUCTURE

FROM: 4 CASDAC LEVEL IV

| INPUT                    |                                 | PROCESS                                  | OUTPUT                               |
|--------------------------|---------------------------------|--|--------------------------------------|
| 3                        | CONTRACT SPECS                  | 1. ANALYZE LEVEL III OUTPUT              | E.3                                  |
| 3                        | CONTRACT & GUIDANCE<br>DRAWINGS | 2. PERFORM HVAC CALCULATIONS             | 5                                    |
| 4.4<br>4.2<br>4.3<br>4.5 | INTERFACE DATA                  | 3. PREPARE HVAC CONSTRUCTION<br>DRAWINGS | 5<br>4.2<br>4.3<br>4.4<br>4.5<br>4.6 |

TO: 4.7.1, 4.7.2, 4.7.3, 4.7.4, 4.7.5, 4.7.6, 4.7.7, 4.7.8

BOX: 4.7

TITLE: CAVDAC IV



FROM: 4.7 CAVDAC

INPUT

PROCESS

OUTPUT

|         |  |
|---------|--|
| 3       | CONTRACT SPECS   |
| 3       | CONTRACT & GUIDANCE<br>DRAWINGS (GENERAL<br>ARRANGEMENT, HVAC<br>DIAG. & SCANTLINGS) |
| 4.3.1.2 | C & A  |

|   |
|---|
| 1. DETERMINE HULL INSULATION<br>REQUIREMENTS          |
| 2. DETERMINE REFRIGERATION<br>INSULATION REQUIREMENTS |
| 3. DETERMINE FIRE INSULATION<br>REQUIREMENTS          |

|                     |                                       |
|---------------------|---------------------------------------|
| INSULATION ANALYSIS | 4.7.4<br>4.7.3<br>4.7.7<br>4.3<br>4.2 |
|---------------------|---------------------------------------|

TO: 4.7.1.1, 4.7.1.2, 4.7.1.3

BOX: 4.7.1

TITLE: ANALYZE INSULATION REQUIREMENTS

FROM: 4.7.1 ANALYZE INSULATION REQUIREMENTS

| INPUT   |   | PROCESS  | OUTPUT                                   |
|---------|---|--|--|
| 3       | CONTRACT SPECS, 9380-1, 9390-1, 9390-4                          | 1. DETERMINE DESIGN TEMPERATURE FOR EACH COMPARTMENT<br><br>2. DETERMINE TYPE & THICKNESS OF INSULATION FOR ALL COMPARTMENT BOUNDARIES<br><br>3. REVIEW (2) ABOVE AFTER LOADS ARE CALCULATED | COMPARTMENT INSULATION LISTS             |
| 3       | CONTRACT & GUIDANCE DRAWINGS (GEN ARR, HVAC DIAG. & SCANTLINGS) |  | 4.3.1.1<br>4.3.1.3<br>4.3.1.2<br>4.3.2.4 |
| 4.3.1.2 | C & A DRAWINGS  |  | 4.7.3.1<br>4.7.3.4                       |
| 4.7.3   | HEATING AND COOLING LOADS                                       |  | 4.7.4.1<br>4.7.7.1                       |

TO: NONE

BOX: 4.7.1.1

TITLE: HULL INSULATION REQUIREMENTS

FROM: 4.7.1 ANALYZE INSULATION REQUIREMENTS

INPUT

|         |                                   |
|---------|-----------------------------------|
| 3       | CONTRACT SPECS, 9390-1,<br>9390-4 |
| 3       | CONTRACT & GUIDANCE<br>DRAWINGS   |
| 4.3.1.2 | C & A DRAWINGS                    |

PROCESS

|    |  |
|----|--|
| 1. | DETERMINE DESIGN TEMPERA-<br>TURES AND INSULATING MATER-<br>IAL FOR EACH REFRIGERATED<br>SPACE |
| 2. | CALCULATE INSULATION THICK-<br>NESS FOR REFRIGERATED<br>SPACES                                 |

OUTPUT

|                                  |  |
|----------------------------------|--|
| REFRIGERATED INSULATION<br>LISTS | 4.3.1.1<br>4.3.1.3<br>4.3.2.4<br>4.3.2.3 |
| DESIGN TEMPERATURES              | 4.2.1.2.1<br>4.7.4.1                     |

TO: NONE

BOX: 4.7.1.2

TITLE: REFRIGERATION INSULATION REQUIREMENTS

FROM: 4.7.1 ANALYZE INSULATION REQUIREMENTS

OUTPUT

FIRE INSULATION LIST  
FIRE BOUNDARIES

4.3.2.4  
4.3.1.3  
4.3.1.2

PROCESS

1. SCOPE OUT THE FIRE INSULATION REQUIREMENTS AND THE SPECIFIED FIRE BOUNDARIES

INPUT

CONTRACT SPECS,  
CONTRACT & GUIDANCE  
DRAWINGS

C & A DRAWINGS

3  
3  
4.3.1.2

TO: NONE

BOX: 4.7.1.3

TITLE: FIRE INSULATION REQUIREMENTS

FROM: 4.7 CAVDAC

| INPUT   |                          | PROCESS   | OUTPUT                      |
|---------|--------------------------|---|-----------------------------|
| 3       | CONTRACT SPECS           | 1. PREPARE ROUGH HVAC DIAGRAM                     | PRELIMINARY L/M             |
| 3       | CONTRACT & GUIDANCE HVAC | 2. PERFORM PRELIMINARY PRESSURE DROP CALCULATIONS | PRELIMINARY DIAGRAM-MATIC   |
| 4.2.3.1 | MACHINERY ARR. DWGS.     | 3. PREPARE WEIGHT & MOMENT ESTIMATES              |                             |
| 4.7.3   | SYSTEM ANALYSIS          | 4. PREPARE HVAC INSTRUCTIONS                      |                             |
| 4.3     | HULL ARR DWGS            | 5. PREPARE PRELIMINARY L/M                        |                             |
|         |                          |   | PRELIMINARY DUCT SIZES      |
|         |                          |   | WEIGHT AND MOMENT ESTIMATES |
|         |                          |   | INSTRUCTIONS                |

E.3  
4.7.4  
4.7.2.5  
4.7.2.4  
4.7.3  
4.7.4  
4.4  
4.5  
4.7.6  
4.7.2.3  
4.7.5  
4.3  
4.7.4  
4.7.5  
4.7.7  
4.7.8

TO: 4.7.2.1, 4.7.2.2, 4.7.2.3, 4.7.2.4, 4.7.2.5

BOX: 4.7.2

TITLE: PRELIMINARY HVAC STUDIES

FROM: 4.7.2 PRELIMINARY HVAC STUDIES

OUTPUT

|                    |   |
|--------------------|---|
| ROUGH HVAC DIAGRAM | 4.4.3<br>4.5<br>4.7.3.1<br>4.7.3.2<br>4.7.3.3<br>4.7.3.4<br>4.7.4.1<br>4.7.2.2<br>4.7.2.3<br>4.7.2.4<br>4.7.2.5 |
|--------------------|---|

PROCESS

|  |
|--|
| 1. MODIFY LEVEL III CONTRACT<br>DRAWING TO REFLECT LATEST<br>DECK ARRANGEMENTS, FIRE<br>ZONING, MAIN MACHINERY<br>ARRANGEMENTS, HVAC EQUIP-<br>MENT SPACES |
|--|

INPUT

|         |   |
|---------|---|
| 3       | CONTRACT SPECS  |
| 3       | CONTRACT & GUIDANCE<br>DRAWINGS   |
| 4.3.1.2 | C&A DRAWINGS  |
| 4.2.3.1 | MAIN MACHINERY, PUMP<br>ROOM, REFRIGERATION<br>MACHINERY ROOM &<br>MISCELLANEOUS MACHIN-<br>ERY ROOM ARRANGEMENTS |

TO: NONE

BOX: 4.7.2.1

TITLE: ROUGH HVAC DIAGRAM

FROM: 4.7.2 PRELIMINARY HVAC STUDIES

INPUT

|         |                    |
|---------|--------------------|
| 3       | CONTRACT SPECS     |
| 4.7.2.1 | ROUGH HVAC DIAGRAM |
| 4.3.1.2 | C&A DRAWINGS       |

PROCESS

|  |
|--|
| 1. PERFORM PRELIMINARY<br>PRESSURE DROP CALCULATIONS<br>FOR ALL HVAC SYSTEMS |
| 2. SIZE SECTIONS   |

OUTPUT

|                                 |  |
|---------------------------------|--|
| PRELIMINARY DUCTING<br>SIZES    | 4.7.2.3<br>4.7.5.1<br>4.7.6.1<br>4.7.6.2 |
| PRESSURE DROP CALCU-<br>LATIONS | 4.7.6.2                                  |

TO: NONE

BOX: 4.7.2.2

TITLE: PRELIMINARY PRESSURE DROP

FROM: 4.7.2 PRELIMINARY HVAC STUDIES

INPUT

PROCESS

OUTPUT

|         |                    |
|---------|--------------------|
| 4.7.2.1 | ROUGH HVAC DIAGRAM |
| 4.7.2.2 | DUCTING SIZES      |
| 4.7.2.4 | PRELIMINARY L/M    |

|                                      |
|--------------------------------------|
| 1. PREPARE WEIGHT & MOMENT ESTIMATES |
|--------------------------------------|

|                           |         |
|---------------------------|---------|
| WEIGHT & MOMENT ESTIMATES | 4.3.1.3 |
|---------------------------|---------|

TO: NONE

BOX: 4.7.2.3

TITLE: WEIGHT & MOMENT ESTIMATES



FROM: PRELIMINARY HVAC STUDIES

INPUT

|         |                    |
|---------|--------------------|
| 4.7.2.1 | ROUGH HVAC DIAGRAM |
| 3       | CONTRACT SPECS     |

PROCESS

|                            |
|----------------------------|
| 1. PREPARE PRELIMINARY L/M |
|----------------------------|

OUTPUT

|                      |   |
|----------------------|---|
| PRELIMINARY HVAC L/M | E.3<br>4.7.4<br>4.7.5<br>4.7.6<br>4.7.7 |
|----------------------|---|

TO: NONE

BOX: 4.7.2.4

TITLE: PRELIMINARY L/M

FROM: 4.7.2 PRELIMINARY HVAC STUDIES

INPUT

PROCESS

OUTPUT

|   |                             |
|---|-----------------------------|
| 3 | CONTRACT SPECS<br>STANDARDS |
|---|-----------------------------|

|   |
|---|
| 1. PREPARE INSTRUCTIONS<br>CONCERNING DUCT INSULATION,<br>FABRICATION, & INSTALLATION |
|---|

|                   |                    |
|-------------------|--------------------|
| HVAC INSTRUCTIONS | 4.7.4.1<br>4.7.7.2 |
|-------------------|--------------------|

TO: NONE

BOX: 4.7.2.5

TITLE: HVAC INSTRUCTIONS

FROM: 4.7 CAVDAC

INPUT

PROCESS

OUTPUT

|       |   |  |                     |  |
|-------|---|--|---------------------|--|
| 3     | CONTRACT SPECS                                | 1. CALCULATE HEATING AND COOL-<br>ING LOADS                              | CALCULATION RESULTS | 4.7.4  |
| 3     | CONTRACT & GUIDANCE<br>DRAWINGS               | 2. CALCULATE AIR QUANTITIES<br>FOR NON-AIR-CONDITIONED<br>COMPARTMENTS   | SIZES OF COMPONENTS | 4.7.4<br>4.7.6<br>4.4<br>4.7.5<br>4.5<br>4.7.7 |
| 4.7.1 | COMPOSITE DRAWINGS                            | 3. PERFORM COOLING COIL RECA-<br>PITULATION CONVENTIONAL<br>CALCULATIONS |                     |  |
| 4.7.2 | INSULATION REQUIREMENTS                       | 4. PERFORM HEATING ANALYSIS<br>AND SIZE HEATERS                          |                     |  |
| 4.2.1 | PREL. HVAC STUDIES                            | 5. SELECT GRAVITY TYPE COOL-<br>ING COILS                                |                     |  |
| 4.3   | LIST OF SHIPS EQUIPMENT<br>& HEAT DISSIPATION |  |                     |  |
| 4.5   |   |  |                     |  |

TO: 4.7.3.1, 4.7.3.2, 4.7.3.3, 4.7.3.4

BOX: 4.7.3

TITLE: HEATING & COOLING LOADS AND SYSTEM ANALYSIS

FROM: 4.7.3 HEATING AND COOLING LOADS

| INPUT  | PROCESS   | OUTPUT   |
|--|---|--|
| <div>4.7.1</div> <div>COMPARTMENT DESIGN TEMPERATURES &amp; INSULATION REQUIREMENTS</div> <div>4.5</div> <div>COMPARTMENT LIGHTING</div> <div>4.2.1</div> <div>COMPARTMENT/MACHINERY &amp; EQUIPMENT HEAT LOADS</div> <div>4.3.2.3</div> <div>4.5</div> <div>3</div> <div>PERSONNEL HEAT INPUT (MANNING DOCUMENT)</div> <div>4.3.1.2</div> <div>C&amp;A DRAWINGS</div> | <div>1. CALCULATE COOLING &amp; HEATING LOAD FOR EACH COMPARTMENT REQUIRING VENTILATION AND/OR AIR-CONDITIONING</div> <div>2. CALCULATE TOTAL HEATING AND TOTAL COOLING LOADS</div> | <div>COMPARTMENT &amp; TOTAL COOLING &amp; HEATING LOADS</div> <div>4.7.3.2</div> <div>4.7.3.3</div> <div>4.7.3.4</div> <div>4.7.3.5</div> |

TO: NONE

BOX: 4.7.3.1

TITLE: CALCULATE HEATING & COOLING LOADS

FROM: 4.7.3 HEATING AND COOLING LOADS

INPUT

|         |                |
|---------|----------------|
| 4.7.3.1 | HEATING LOADS  |
| 4.3.1.2 | C&A DRAWINGS   |
| 3       | CONTRACT SPECS |

PROCESS

|    |  |
|----|--|
| 1. | CALCULATE VENTILATION AIR QUANTITIES FOR NON-AIR-CONDITIONED SPACES    |
| 2. | SELECT CONVECTION-TYPE HEATERS FOR SPACES DESIGNATED IN CONTRACT SPECS |

OUTPUT

|                         |                             |
|-------------------------|-----------------------------|
| VENTILATION REQMTS      | 4.7.5<br>4.7.4.1<br>4.7.6.2 |
| LIST OF CONVECTION HTRS | 4.7.4.2                     |

TO: NONE

BOX: 4.7.3.2

TITLE: AIR FOR NON-AC COMPARTMENTS

FROM: 4.7.3 HEATING AND COOLING LOADS

INPUT

|         |                    |
|---------|--------------------|
| 4.7.2.1 | ROUGH HVAC DIAGRAM |
| 4.7.3.1 | COOLING LOADS      |

PROCESS

|  |
|--|
| 1. DIVIDE AIR CONDITIONED SPACES INTO PARTICULAR AIR-CONDITIONED SYSTEMS |
| 2. CALCULATE REQUIRED RE-PLENISHMENT AIR                                 |
| 3. CALCULATE COOLING COIL SIZES  |
| 4. CALCULATE AIR QUANTITIES FOR EACH AIR CONDITIONED SPACE               |

OUTPUT

|                    |   |
|--------------------|---|
| COOLING COIL SIZES | 4.7.4.2   |
| AIR QUANTITIES     | 4.7.5<br>4.7.6.2<br>4.7.4.1<br>4.4<br>4.2.1.2.1 |

TO: NONE

BOX: 4.7.3.3

TITLE: COOLING COIL RECAPITULATION CALCULATIONS

FROM: 4.7.3 HEATING AND COOLING LOADS

| INPUT                         | PROCESS  | OUTPUT                               |
|-------------------------------|--|--------------------------------------|
| 4.7.2.1<br>ROUGH HVAC DIAGRAM | 1. SELECT FAN SIZES FOR SYSTEMS                      | LIST OF FAN SIZES                    |
| 4.7.3.1<br>HEATING LOADS      | 2. SELECT PRE-HEATERS FOR APPROPRIATE SUPPLY SYSTEMS | 4.7.4.2<br>4.7.5.1<br>4.5<br>4.7.2.1 |
|                               | 3. DETERMINE THE GROUPING OF SPACES ON REHEATERS     | LIST OF PRE-HEATERS                  |
|                               | 4. DETERMINE HEATER SIZES                            | REHEATER GROUPINGS                   |
|                               |  | LIST OF HEATER SIZES                 |
|                               |  | 4.7.4.2<br>4.4<br>4.7.2.1            |

TO: NONE

BOX: 4.7.3.4

TITLE: HEATING ANALYSIS

FROM: 4.7 CAVDAC

PROCESS

INPUT

|         |                           |       |
|---------|---------------------------|-------|
| 3       | CONTRACT SPECS            | 5.6   |
| 3       | COMPOSITE DRAWINGS        | E.3   |
| 4.7.1   | COMPARTMENT DESIGN TEMPS  | E.1.2 |
| 4.7.3   | HVAC CALCULATIONS         | 4.7.5 |
| 4.7.7   | PRELIM HVAC STUDIES       | 4.7.6 |
| 4.7.6   | ROUTING & SIZING OF DUCTS | 4.7.7 |
| 4.3.1.2 | C&A DRAWINGS              | 4.4   |
|         |                           | 4.5   |
|         |                           | 4.3   |
|         |                           | 4.2.1 |

|                           |  |
|---------------------------|--|
| HVAC DIAGRAMMATIC DRAWING |  |
| HVAC EQUIPMENT LISTS      |  |

TO: 4.7.4.1, 4.7.4.2

BOX: 4.7.4

TITLE: DIAGRAMMATIC AND EQUIPMENT LIST



FROM: 4.7.4 DIAGRAMMATIC AND EQUIPMENT LIST

| INPUT  | PROCESS   | OUTPUT   |
|--|---|--|
| <div>4.7.2.1 ROUGH HVAC DIAGRAM</div> <div>4.7.3.3 AIR QUANTITIES</div> <div>4.7.3.3 COOLING COIL SIZES</div> <div>4.7.3.2 VENTILATION REQMTS</div> <div>4.7.1.1 DESIGN TEMPERATURES</div> <div>4.7.2.0 PRELIMINARY L/M</div> <div>4.7.1.1 INSULATION</div> <div>4.7.1.2</div> <div>4.7.1.3</div> <div>4.7.2.5 HVAC INSTRUCTIONS</div> <div>4.3.1.2 C&amp;A DRAWINGS</div> | <div>1. PREPARE HVAC DIAGRAMMATIC BY</div> <ul style="list-style-type: none"> <li>ROUTING SYSTEMS AND LOCATING EQUIPMENT</li> <li>INDICATING CLOSURE VALVES, WATERTIGHT DUCT WORK, THERMOSTATIC CONTROLS, DAMPERS, COMPARTMENT TEMPERATURES AND AIR FLOW QUANTITIES AND RATES OF CHANGE</li> <li>ADD ANY REQUIRED NOTES, SPECIAL EQUIPMENT, EQUIP-NUMBERS AND DAMAGE CONTROL CLASSIFICATIONS</li> </ul> | <div>HVAC DIAGRAMMATIC DRAWINGS</div> <div>5.7</div> <div>E.3.1</div> <div>E.3.2</div> <div>4.7.5.1</div> <div>4.7.5.2</div> <div>4.7.6.1</div> <div>4.7.6.2</div> <div>4.7.7.1</div> <div>4.7.7.2</div> <div>4.4</div> <div>E.1.2</div> <div>4.5</div> <div>4.3.1.1</div> <div>4.3.2.3</div> <div>4.2.1.2.1</div> |

TO: NONE

BOX: 4.7.4.1

TITLE: HVAC DIAGRAMMATIC

# FROM: 4.7.4 DIAGRAMMATIC AND EQUIPMENT LIST

| INPUT  | PROCESS  | OUTPUT   |
|--|--|--|
| <div>4.7.2.1 HVAC DIAGRAMMATIC</div> <div>4.7.1.1 INSULATION</div> <div>4.7.1.2</div> <div>4.7.1.3</div> <div>4.7.2.4 PRELIMINARY L/M</div> <div>4.7.3.2 LISTS</div> <div>4.7.3.3</div> <div>4.7.3.4</div> | <div>1. PREPARE THE FOLLOWING EQUIPMENT LISTS:</div> <ul style="list-style-type: none"> <li>• FAN</li> <li>• STEAM &amp; ELECTRIC HEATER</li> <li>• CONVECTOR HEATER</li> <li>• COOLING COIL</li> <li>• FLAME ARRESTER</li> <li>• AIR FACTOR</li> <li>• VALVE</li> <li>• INSULATION</li> </ul> | <div>FAN LIST</div> <div>5.7</div> <div>E.3.1</div> <div>E.3.2</div> <div>4.4</div> <div>4.5</div> <div>4.2.1.2.1</div> <div>STEAM &amp; ELECTRIC HEATER LIST</div> <div>CONVECTOR HEATER LIST</div> <div>COOLING COIL LIST</div> <div>FLAME ARRESTER LIST</div> <div>AIR FILTER LIST</div> <div>VALVE LIST</div> <div>INSULATION LIST</div> |

TO: NONE

BOX: 4.7.4.2

TITLE: EQUIPMENT LIST

FROM: 4.7 CAVDAC

INPUT

|         |   |
|---------|---|
| 4.8     | COMPOSITE DRAWINGS                                    |
| 4.3     | STRUCTURAL DRAWINGS                                   |
| 4.7.4   | HVAC DIAGRAMMATIC                                     |
| 4.3     | NOISE REDUCTION AND<br>ACOUSTIC TREATMENT<br>ANALYSIS |
| 4.7.2.5 | HVAC INSTRUCTIONS                                     |
| 4.7.3   | SYSTEM ANALYSIS                                       |

PROCESS

|  |
|--|
| 1. PREPARE FAN ROOM ARRANGEMENT DRAWINGS         |
| 2. PREPARE DRAWINGS FOR MAJOR VENTILATION TRUNKS |

OUTPUT

|                                  |  |
|----------------------------------|--|
| FAN ROOM ARRANGEMENT DRAWINGS    | 5.7<br>E.3.1<br>E.3.2                      |
| MAJOR VENTILATION TRUNK DRAWINGS | 4.3<br>4.7.6<br>4.7.7<br>4.4<br>4.5<br>4.3 |

TO: 4.7.5.1, 4.7.5.2

BOX: 4.7.5

TITLE: FAN ROOMS & VENTILATION TRUNKS

FROM: 4.7.5 FAN ROOMS & VENTILATION TRUNKS

INPUT

|         |                     |
|---------|---------------------|
| 4.7.4.2 | EQUIPMENT LISTS     |
| 4.3.1.2 | C&A DRAWINGS        |
|         | COMPOSITE DRAWINGS  |
| 4.3.2.1 | STRUCTURAL DRAWINGS |
| 4.7.4.1 | HVAC DIAGRAMMATIC   |
| 4.7.2.5 | HVAC INSTRUCTIONS   |
| 4.7.3   | SYSTEM ANALYSIS     |
| 4.8     | DESIGN INTEGRATION  |

PROCESS

|   |
|---|
| 1. PREPARE ARRANGEMENT<br>DRAWINGS OF FAN ROOMS |
|---|

OUTPUT

|                                  |   |
|----------------------------------|---|
| FAN ROOM ARRANGEMENT<br>DRAWINGS | 4.3.2.2<br>4.3.1.2<br>4.3.1.1<br>4.3.2.1<br>4.5<br>4.4<br>5.7<br>E.3.1<br>E.3.2 |
|----------------------------------|---|

TO: NONE

BOX: 4.7.5.1

TITLE: FAN ROOM ARRANGEMENTS

FROM: 4.7.5 FAN ROOMS & VENTILATION TRUNKS

| INPUT  | PROCESS   | OUTPUT  |
|--|---|---|
| <div>4.7.4.1 HVAC DIAGRAMMATIC</div> <div>4.3.1.2 C&amp;A DRAWINGS</div> <div>4.3.2.1 STRUCTURE</div> <div>4.3.2.4 NOISE REDUCTION &amp; ACOUSTIC TREATMENT ANALYSIS</div> | <div>1. PREPARE DETAIL SKETCHES OF ALL MAJOR VENTILATION TRUNKS TO ENSURE THAT PRELIMINARY ESTIMATES ARE NOT EXCEEDED</div> | <div>VENTILATION TRUNK ANALYSIS</div> <div>4.3.1.2</div> <div>4.3.2.1</div> |

TO: NONE

BOX: 4.7.5.2

TITLE: VENTILATION TRUNKS

FROM: 4.7 CAVDAC

OUTPUT

|                     |       |
|---------------------|-------|
| SINGLE LINE ROUTING | 4.7.7 |
| DUCT SIZES          | 4.7.7 |

PROCESS

|   |
|---|
| 1. PREPARE SINGLE LINE ROUTING                |
| 2. CALCULATE PRESSURE DROPS &<br>SIZE DUCTING |

INPUT

|         |   |
|---------|---|
| 3       | CONTRACT SPECS<br>HVAC DESIGN CRITERIA<br>MANUAL                    |
| 4.3     | DECKS, PLATFORM, BHDS,<br>FRAMING, AND SUPER-<br>STRUCTURE DRAWINGS |
| 4.8     | COMPOSITE DRAWINGS  |
| 4.7.4   | HVAC DIAGRAMMATIC   |
| 4.7.5   | FAN ROOM ARR & TRUNK<br>SIZE  |
| 4.7.3   | COMPONENT SIZES   |
| 4.7.2   | PRELIMINARY DUCT SIZES  |
| 4.2.3.1 | MACHINERY ARR DRAWINGS  |

TO: 4.7.6.1, 4.7.6.2

BOX: 4.7.6

TITLE: ROUTE & SIZE DUCTS

FROM: 4.7.6 ROUTE & SIZE DUCTS

INPUT

PROCESS

OUTPUT

|   |                        |                        |                               |
|---|------------------------|------------------------|-------------------------------|
| 3   | CONTRACT SPECS         | ROUTING OF ALL DUCTING | 4.7.6.2<br>4.7.7.1<br>4.2.3.1 |
| 4.4   | COMPOSITE DRAWING      |                        |                               |
| 4.3.1.2   | C&A DRAWINGS           |                        |                               |
| 4.7.4.1   | HVAC DIAGRAMMATIC      |                        |                               |
| 4.7.5.2   | VENTILATION TRUNKS     |                        |                               |
| 4.7.5.1   | FAN ROOM ARR           |                        |                               |
| 4.7.3   | COMPONENT SIZES        |                        |                               |
| 4.7.2   | PRELIMINARY DUCT SIZES |                        |                               |
| 1. PREPARE SINGLE LINE ROUTING<br>OF ALL DUCTING SECTIONS |                        |                        |                               |

TO: NONE

BOX: 4.7.6.1

TITLE: SINGLE LINE ROUTING

FROM: 4.7.6 ROUTE & SIZE DUCTS

INPUT

PROCESS

OUTPUT

|         |                                 |
|---------|---------------------------------|
| 4.7.6.1 | SINGLE LINE ROUTING<br>OF DUCTS |
| 4.7.4.1 | HVAC DIAGRAMMATIC               |
| 4.7.2   | PRELIMINARY DUCT SIZES          |
| 4.7.2   | PRESSURE DROP CALCULATIONS      |

|   |
|---|
| 1. CALCULATE PRESSURE DROPS<br>IN ALL DUCTING SECTIONS &<br>DETERMINE APPROPRIATE ROUND<br>AND RECTANGULAR DUCT SIZES |
|---|

|                       |         |
|-----------------------|---------|
| INDIVIDUAL DUCT SIZES | 4.7.7.1 |
|-----------------------|---------|

TO: NONE

BOX: 4.7.6.2

TITLE: SIZE DUCTING



FROM: 4.7 CAVDAC

INPUT

PROCESS

OUTPUT

|       |  |
|-------|--|
| 3     | CONTRACT SPECS<br>HVAC DESIGN CRITERIA<br>MANUAL |
| 4.8   | COMPOSITE DRAWINGS                               |
| 4.7.4 | HVAC DIAGRAMMATICS &<br>EQUIPMENT LIST           |
| 4.7.5 | HVAC FAN ROOM ARRGT'S<br>& TRUNK SIZES           |
| 4.7.6 | HVAC ROUTING & SIZING<br>OF DUCTS                |
| 4.4   | AC CHILLED WATER CIR-<br>CULATING SYSTEM         |
| 4.7.2 | HVAC INSTRUCTIONS                                |

|  |
|--|
| 1. PREPARE ARRANGEMENT DRAW-<br>INGS AND L/M       |
| 2. PREPARE LABEL PLATE LIST &<br>BLANK FLANGE LIST |

|  |   |
|--|---|
| ARRANGEMENT; DETAIL &<br>B/M OF ALL HVAC SYSTEMS | 5.7<br>E.3.1<br>E.3.2<br>E.1.2<br>4.4<br>4.7.7.1<br>4.5<br>4.3<br>4.2.3.1 |
| FOUNDATION DESIGN INFOR-<br>MATION               | 4.3   |

TO: 4.7.7.1, 4.7.7.2

BOX: 4.7.7

TITLE: ARRANGEMENT DRAWINGS & L/M

FROM: 4.7 ARRANGEMENT DRAWINGS & L/M

| INPUT   |  | PROCESS  | OUTPUT                           |
|---------|--|--|----------------------------------|
| 3       | CONTRACT SPECS HVAC DESIGN CRITERIA MANUAL | 1. PREPARE AND CHECK HVAC ARRANGEMENT DRAWINGS AND BILL OF MATERIALS | HVAC ARRANGEMENT DRAWING AND B/M |
| 4.4.2   | COMPOSITE                                  |  |                                  |
| 4.3.2.4 | NOISE ANALYSIS & ACOUSTIC TREATMENT        |  |                                  |
| 4.7.4.1 | HVAC DIAGRAMMATIC                          |  |                                  |
| 4.7.5.1 | FAN ROOM ARR DRAWING                       |  |                                  |
| 4.7.5.2 | MAJOR VENTILATION TRUNK DRAWING            |  |                                  |
| 4.7.6.1 | SINGLE LINE ROUTING                        |  |                                  |
| 4.7.6.2 | DUCT SIZES                                 |  |                                  |
| 4.7.4.2 | HVAC EQUIPMENT LIST                        |  |                                  |
| 4.7.2.5 | HVAC INSTRUCTIONS                          |  |                                  |
| 4.3.1.2 | C&A  |  | 5.7                              |
| 4.3.2.1 | STRUCTURE DESIGN INTEGRATION               |  | 4.3.1.1                          |
|         |  |  | 4.4                              |
|         |  |  | 4.5                              |
|         |  |  | E.3.1                            |
|         |  |  | E.3.2                            |
|         |  |  | E.1.2                            |
|         |  |  | 4.2.3.1                          |

TO: NONE

BOX: 4.7.7.1

TITLE: ARRANGEMENT DRAWINGS & B/M

FROM: 4.7.7 ARRANGEMENT DRAWINGS & L/M

| INPUT  | PROCESS   | OUTPUT  |
|--|---|---|
| <div data-bbox="513 1711 1171 1850"> <p>4.7.4.1</p> <p>4.7.7.1</p> </div> <div data-bbox="513 1358 1171 1711"> <p>HVAC DIAGRAMMATIC</p> <p>HVAC ARRANGEMENT<br/>DRAWING &amp; B/M</p> </div> | <div data-bbox="513 812 1171 1308"> <p>1. PREPARE REQUIRED MISCELLANEOUS LIST (E.G., LABEL PLATE, BLANK FLANGES, ETC.)</p> </div> | <div data-bbox="513 373 1171 758"> <p>MISCELLANEOUS LISTS</p> </div> <div data-bbox="513 203 1171 373"> <p>5</p> <p>E.3.1</p> <p>E.3.2</p> </div> |

TO: NONE

BOX: 4.7.7.2

TITLE: HVAC LISTS

FROM: 4.7 CAVDAC

INPUT

PROCESS

OUTPUT

|         |                   |
|---------|-------------------|
| 3       | CONTRACT SPECS    |
| 4.7.4.1 | HVAC DIAGRAMMATIC |
| 4.7.7.1 | ARR DRAWING & B/M |

|  |
|--|
| 1. REVIEW INPUT  |
| 2. PREPARE TEST SPECIFICATION<br>FOR BALANCING AND TEST OF<br>ALL HVAC SYSTEMS |
| 3. PREPARE TEST REPORTS  |

|                     |       |
|---------------------|-------|
| TEST SPECIFICATIONS | 5     |
| TEST REPORTS        | E.1.3 |

TO: NONE

BOX: 4.7.8

TITLE: HVAC TESTS

DESIGN INTEGRATION 4.8

HIPO

DIAGRAM

FROM: 4 CASDAC LEVEL IV

INPUT

PROCESS

OUTPUT

|  |   |  |  |
|--|---|--|--|
| <p>3</p> <p>E.2</p> <p>4.1<br/>THROUGH<br/>4.7</p> | <p>CONTRACT<br/>SPECIFICATIONS</p> <p>VENDORS' DATA</p> <p>SHIP DESIGN DATA</p> | <p>1. REVIEW AND RESOLVE DESIGN<br/>CONFLICTS</p> <p>NOTE: THIS FUNCTION IS<br/>ACCOMPLISHED BY SEVERAL<br/>DIFFERENT TECHNIQUES IN<br/>THE VARIOUS SHIPYARDS.<br/>SOME USE WHOLE DECK<br/>COMPOSITES WHILE OTHERS<br/>DEVELOP COMPOSITES ONLY<br/>FOR HIGH DENSITY ARRANGE-<br/>MENTS. MUCH OF THE<br/>INTEGRATION FUNCTION IS<br/>ACCOMPLISHED BY THE<br/>ENGINEER RESPONSIBLE FOR<br/>THE SUBJECT SPACE. THESE<br/>VARYING METHODS MAKE IT<br/>DIFFICULT TO DIAGRAM<br/>THIS PARTICULAR FUNCTION.</p> | <p>DESIGN INTERFACE<br/>INFORMATION AND<br/>CONFLICT RESOLUTION</p> <p>4.1<br/>THROUGH<br/>4.7</p> |
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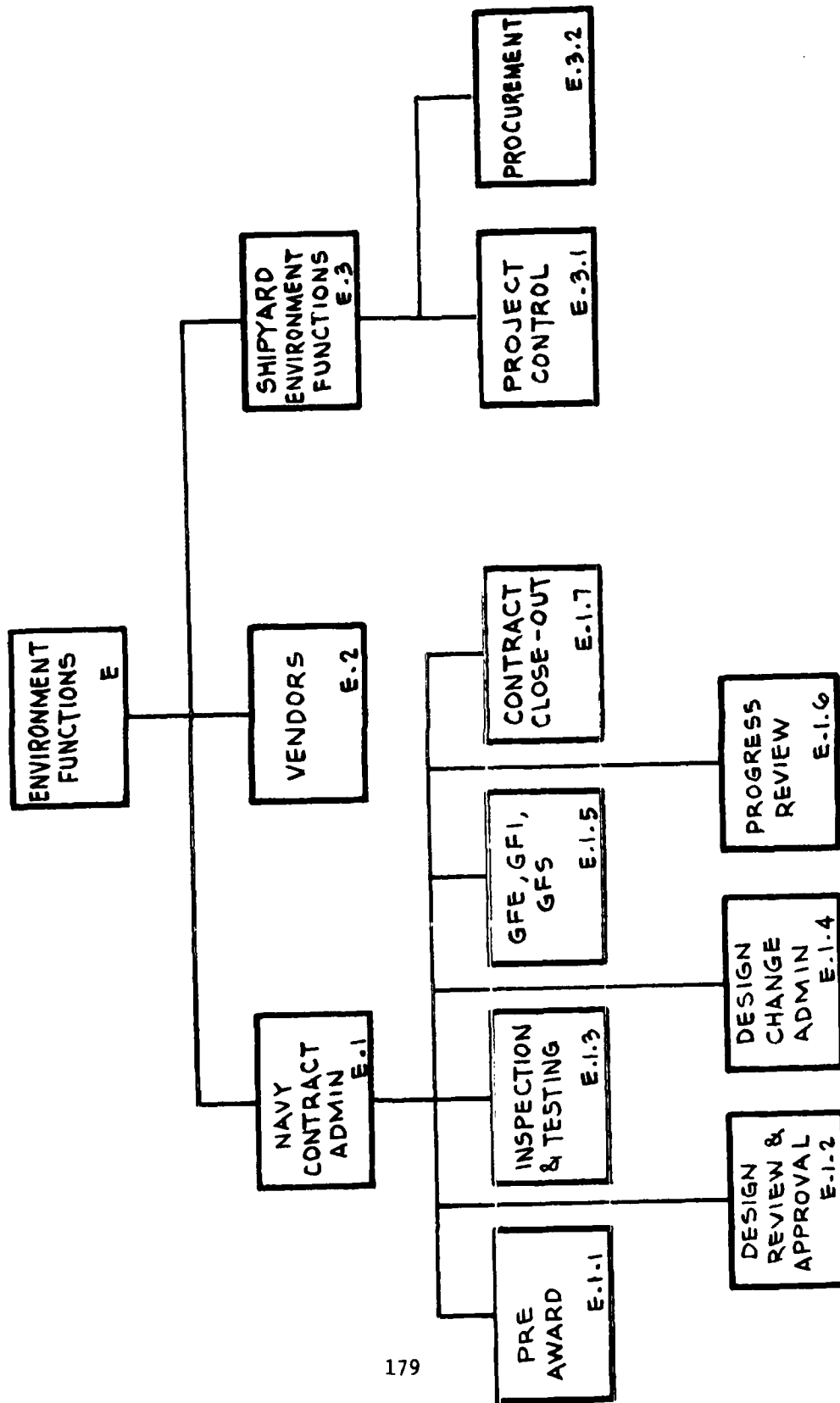
BOX: 4.8

TITLE: DESIGN INTEGRATION

## ENVIRONMENTAL

### FUNCTIONS E

NOTE: This structure chart was developed to provide visibility to some of the environmental interfaces with CASDAC Level IV. Some inputs and outputs on the HIPO diagrams refer to these "E" addresses.



TITLE: ENVIRONMENTAL FUNCTIONS STRUCTURE



APPENDIX B

LISTING OF FUNCTIONAL HIERARCHY

#### CASDAC LEVEL IV FUNCTIONAL HIERARCHY

- 4 CASDAC LEVEL IV
- 4.1 LEVEL IV MANAGEMENT SYSTEM
- 4.2 CAMDAC IV
- 4.2.1 MACHINERY LIST
- 4.2.1.1 MACHINERY LIST PROPULSION PLANT
  - 4.2.1.1.1 COMPONENTS OF STEAM PLANTS
  - .2 COMPONENTS OF DIESEL PLANTS
  - .3 COMPONENTS OF GAS TURBINE PLANTS
  - .4 COMPONENTS ASSOCIATED WITH POWER TRANSMISSION
  - .5 COMPONENTS ASSOCIATED WITH AUXILIARY, SECONDARY, AND EMERGENCY PROPULSION SYSTEMS
  - .6 PROPULSION CONTROL
- 4.2.1.2 MACHINERY LIST AUXILIARY SYSTEM
  - 4.2.1.2.1 MACHINERY LIST REFRIGERATION AND AIR-CONDITIONED PLANTS
  - 4.2.1.2.2 MACHINERY LIST DISTILLING PLANT
  - 4.2.1.2.3 MACHINERY LIST AUXILIARY BOILER
  - 4.2.1.2.4 MACHINERY LIST O<sub>2</sub>N<sub>2</sub> PLANT
  - 4.2.1.2.5 MACHINERY LIST STEERING GEAR
- 4.2.1.3 MACHINERY LIST ELECTRICAL SYSTEM SUPPORT
  - 4.2.1.3.1 MACHINERY LIST SHIP SERVICE GENERATOR SYSTEM SUPPORT
  - 4.2.1.3.2 MACHINERY LIST EMERGENCY SHIP SERVICE GENERATOR SYSTEM SUPPORT
- 4.2.2 PURCHASE SPECIFICATIONS

- 4.2.3 ARRANGEMENT DRAWINGS
  - 4.2.3.1 MACHINERY ARRANGEMENT DRAWINGS
  - 4.2.3.2 COMBUSTION AIR AND UPTAKES
  - 4.2.3.3 CONDENSER SCOOP
- 4.2.4 DETAIL MACHINERY DRAWINGS
- 4.2.5 EQUIPMENT OPERATING INSTRUCTIONS AND SAFETY PRECAUTIONS
- 4.2.6 PLANT AND ENGINEERING SYSTEM INSTRUCTIONS
- 4.2.7 LABEL PLATES
- 4.2.8 SCHEDULED MAINTENANCE INSTRUCTIONS
- 4.2.9 TEST SPECIFICATIONS
- 4.2.10 PARTS ALLOWANCE LIST
- 4.3 HULDAC LEVEL IV
  - 4.3.1 HULL SYSTEMS ENGINEERING
    - 4.3.1.1 STRUCTURAL ENGINEERING
      - 4.3.1.1.1 STRUCTURAL ENGINEERING ANALYSIS
      - 4.3.1.1.2 FAIR MOLDED LINES
      - 4.3.1.1.3 STRUCTURAL ARRANGEMENT
      - 4.3.1.1.4 DEVELOP SUPERSTRUCTURE
      - 4.3.1.1.5 DETERMINE STRUCTURAL MATERIAL LIST
    - 4.3.1.2 DEVELOP C&A
    - 4.3.1.3 WEIGHT CONTROL
    - 4.3.1.4 NAVAL ARCHITECTURAL CALCULATIONS
      - 4.3.1.4.1 CROSS-FLOODING ANALYSIS
      - 4.3.1.4.2 HYDRODYNAMIC CALCULATIONS

- 4.3.1.4.3 LAUNCHING CALCULATIONS
- 4.3.1.4.4 DOCKING PLAN
- 4.3.2 HULL DETAIL DESIGN
  - 4.3.2.1 STRUCTURAL DETAIL DESIGN
    - 4.3.2.1.1 DECKS, PLATFORMS, MAIN BULKHEADS AND FRAMING DESIGN
    - 4.3.2.1.2 STRUCTURAL DECK HOUSE DETAIL DESIGN
    - 4.3.2.1.3 MISCELLANEOUS STRUCTURAL BULKHEADS
    - 4.3.2.1.4 HULL APPENDAGES DESIGN
    - 4.3.2.1.5 MAST, RAS, FAS DESIGN
  - 4.3.2.2 FOUNDATION DESIGN
  - 4.3.2.3 HULL DETAIL ARRANGEMENTS
    - 4.3.2.3.1 DETAIL EQUIPMENT ARRANGEMENTS
    - 4.3.2.3.2 DEVELOP DECK ARRANGEMENT DESIGN CONTROL DRAWINGS
  - 4.3.2.4 MISCELLANEOUS HULL DETAILS
  - 4.3.2.5 VENDOR DRAWING APPROVAL
- 4.4 CAPDAC IV
  - 4.4.1 PIPING DIAGRAM
  - 4.4.2 COMPOSITE DRAWINGS
  - 4.4.3 ARRANGEMENT DRAWINGS
  - 4.4.4 MATERIAL CONTROL
  - 4.4.5 QUALITY ASSURANCE DRAWINGS
  - 4.4.6 PIPE DETAILS
  - 4.4.7 PIPE HANGER DRAWINGS
  - 4.4.8 OPERATING GEAR DRAWINGS

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DAVID W TAYLOR NAVAL SHIP RESEARCH AND DEVELOPMENT CE--ETC F/G 13/10  
FEASIBILITY MODEL OF CASDAC LEVEL IV/V TOP-DOWN ANALYSIS.(U)  
APR 79 R JENKINS, B M THOMSON  
DTNSRDC/CMLD-79-06

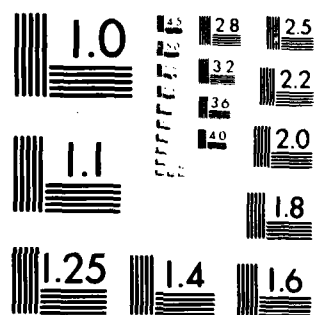
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MICROCOPY RESOLUTION TEST CHART  
NATIONAL BUREAU OF STANDARDS-1963-A

- 4.4.9 LABEL PLATE DRAWINGS
- 4.4.10 TEST SPECIFICATIONS
- 4.4.11 HOSE AND LOCK LISTS
- 4.5 ELXDAC LEVEL IV
  - 4.5.1 ARRANGEMENTS
    - 4.5.1.1 ARRANGEMENTS OF MAJOR ELECTRONIC SPACES
    - 4.5.1.2 ANTENNA ARRANGEMENT
    - 4.5.1.3 RUNNING LIGHTS ARRANGEMENTS
    - 4.5.1.4 ELECTRICAL COMPOSITE DECK PLANS
  - 4.5.2 DRAWINGS AND LIST OF MATERIAL
    - 4.5.2.1 SCHEMATIC DRAWINGS
    - 4.5.2.2 ELEMENTARY DRAWINGS
    - 4.5.2.3 ISOMETRIC DRAWINGS AND LIST OF MATERIAL
    - 4.5.2.4 HOOK-UP LIST
    - 4.5.2.5 TELEPHONE DIRECTORY
    - 4.5.2.6 STANDARD METHODS DRAWING
    - 4.5.2.7 DESIGN DIVISION INSTRUCTIONS
  - 4.5.3 PERFORM SYSTEM ANALYSIS AND CALCULATIONS
    - 4.5.3.1 FAULT CURRENT
    - 4.5.3.2 VOLTAGE DROPS
    - 4.5.3.3 SYNCHRO LOADS
    - 4.5.3.4 SIZING
    - 4.5.3.5 LOAD BALANCING SUMMARIES
    - 4.5.3.6 LOAD SHEDDING

- 4.5.3.7 LIGHTING SURVEYS
- 4.5.3.8 HVAC ANALYSIS
- 4.5.4 PERFORM PRELIMINARY ELECTRICAL/ELECTRONIC STUDIES
  - 4.5.4.1 PRELIMINARY CABLEWAY LAYOUTS
  - 4.5.4.2 CABLE ESTIMATES
  - 4.5.4.3 PRELIMINARY EQUIPMENT SELECTION AND LONG LEAD TIME LIST
  - 4.5.4.4 PRELIMINARY LOAD SUMMARY/FAULT CURRENT
  - 4.5.4.5 PRELIMINARY SYSTEM SKETCHES
  - 4.5.4.6 PRELIMINARY HVAC STUDIES
  - 4.5.4.7 PREPARE WEIGHT AND MOMENT ESTIMATE
- 4.5.5 WIREWAY SIZING AND ROUTING
  - 4.5.5.1 CABLE HANGER DETAILS
  - 4.5.5.2 WIREWAY DETAILS
  - 4.5.5.3 POWER SYSTEM DECK PLANS
  - 4.5.5.4 TRANSMISSION LINE DRAWINGS
  - 4.5.5.5 CABLE HEATING DISSIPATION
  - 4.5.5.6 CABLE SEPARATION REQUIREMENTS
  - 4.5.5.7 EMI/GROUNDING REQUIREMENTS
  - 4.5.5.8 LIGHTING SYSTEM DECK PLANS
- 4.5.6 TEST PROCEDURES
- 4.5.7 PREPARE PROCUREMENT SPECIFICATIONS FOR CFE
  - 4.5.7.1 CONSOLES
  - 4.5.7.2 IC/ACO SWITCHBOARD
  - 4.5.7.3 POWER MG SETS



- 4.5.8 PREPARE OPERATIONAL DOCUMENTS
  - 4.5.8.1 LABEL PLATES REQUIREMENT
  - 4.5.8.2 WARNING/HAZARD SIGNS
  - 4.5.8.3 SHIP'S INFORMATION BOOKS
  - 4.5.8.4 EQUIPMENT OPERATING INSTRUCTIONS
- 4.6 HANDAC LEVEL IV
  - 4.6.1
  - 4.6.2
- 4.7 CAVDAC LEVEL IV
  - 4.7.1 ANALYZE INSULATION REQUIREMENTS
    - 4.7.1.1 HULL INSULATION REQUIREMENTS
    - 4.7.1.2 REFRIGERATION INSULATION REQUIREMENTS
    - 4.7.1.3 FIRE INSULATION REQUIREMENTS
  - 4.7.2 PERFORM PRELIMINARY HVAC STUDIES
    - 4.7.2.1 PREPARE ROUGH HVAC DIAGRAM
    - 4.7.2.2 PERFORM PRELIMINARY PRESSURE DROP CALCULATIONS
    - 4.7.2.3 PREPARE WEIGHT AND MOMENT ESTIMATES
    - 4.7.2.4 PREPARE PRELIMINARY LISTS OF MATERIALS
    - 4.7.2.5 PREPARE HVAC INSTRUCTIONS
  - 4.7.3 CALCULATE HEATING AND COOLING LOADS AND PERFORM SYSTEM ANALYSIS
    - 4.7.3.1 CALCULATE HEATING AND COOLING LOADS
    - 4.7.3.2 CALCULATE AIR QUANTITIES FOR NON-AIR-CONDITIONED COMPARTMENTS
    - 4.7.3.3 COOLING COIL RECAPITULATION CONVENTIONAL CALCULATIONS

- 4.7.3.4 PERFORM HEATING ANALYSIS AND SIZE HEATERS
- 4.7.4 PREPARE FINISHED DIAGRAMMATIC AND EQUIPMENT LIST
- 4.7.4.1 PREPARE HVAC DIAGRAMMATIC
- 4.7.4.2 PREPARE HVAC EQUIPMENT LIST
- 4.7.5 ARRANGEMENT OF FAN ROOMS AND MAJOR VENT TRUNKS
- 4.7.5.1 PREPARE FAN ROOM ARRANGEMENT DRAWINGS
- 4.7.5.2 PREPARE DRAWINGS FOR MAJOR VENTILATION TRUNKS
- 4.7.6 ROUTE AND SIZE DUCTS
- 4.7.6.1 PREPARE SINGLE LINE ROUTING
- 4.7.6.2 CALCULATE PRESSURE DROPS AND SIZE DUCTING
- 4.7.7 PREPARE ARRANGEMENT DRAWINGS AND BILL OF MATERIAL
- 4.7.7.1 PREPARE ARRANGEMENT DRAWINGS AND LIST OF MATERIAL
- 4.7.7.2 PREPARE LABEL PLATE AND BLANK FLANGE LISTS
- 4.7.8 HVAC TESTS
- 4.8 DESIGN INTEGRATION LEVEL IV

## APPENDIX C

### SWBS MATRIX

Note: Assignment of the various line items in this SWBS Matrix is intended to indicate which functional system would have responsibility for that particular line item if or when it becomes included in CASDAC Level IV. Assignment is not intended to infer whether or not a line item is included in the current planned version of CASDAC.

Legend:    X = Primary Responsibility  
          • = Secondary Responsibility

PART II CLASSIFICATION BY NUMERIC GROUPS

SHIP WORK BREAKDOWN STRUCTURE TITLE

GROUP 0 GENERAL GUIDANCE AND ADMINISTRATION

\*\*\*\*\*

000 GENERAL GUIDANCE AND ADMINISTRATION  
010 COMBAT CAPABILITIES (OFFENSIVE AND DEFENSIVE)  
011 AIR WEAPONS VS AIR TARGETS  
012 AIR WEAPONS VS SURFACE TARGETS  
013 AIR WEAPONS VS UNDERWATER TARGETS  
014 SURFACE WEAPONS VS AIR TARGETS  
015 SURFACE WEAPONS VS SURFACE TARGETS  
016 SURFACE WEAPONS VS UNDERWATER TARGETS  
017 UNDERWATER WEAPONS VS SURFACE TARGETS  
018 UNDERWATER WEAPONS VS UNDERWATER TARGETS  
020 STRATEGIC AND SPECIAL CAPABILITIES  
021 SURFACE BASED DETERRENTS  
022 UNDERWATER BASED DETERRENTS  
023 AMPHIBIOUS WARFARE  
024 MINE AND MINE COUNTERMEASURE WARFARE  
025 INSHORE WARFARE  
030 TACTICAL AND STRATEGIC OPER. SUPPORT CAPABILITIES  
031 COMMAND/CONTROL/COMMUNICATIONS  
032 SURVEILLANCE/RECONNAISSANCE/INTELLIGENCE  
033 ELECTRONIC WARFARE AND NUC/BIO/CHEMICAL DEFENSE  
034 LOGISTICS/SEALIFT  
035 OTHER SUPPORT  
040 SHIP SYSTEM MANAGEMENT  
041 PROJECT MANAGEMENT  
042 GENERAL ADMINISTRATIVE REQUIREMENTS  
043 LIFE CYCLE COSTING  
044 SHIP OPERATION  
050 SHIP SYSTEM PERFORMANCE  
051 SHIP SYSTEM PERFORMANCE CONCEPTS  
052 SHIP SUBSYSTEM PERFORMANCE CONCEPTS  
053 SELECTED CONCEPTS  
054 COMPONENT DEVELOPMENT  
060 SUBSYSTEM CHARACTERISTICS (INTERFACES AND CMO CONT.)  
061 HULL STRUCTURE  
062 PROPULSION PLANT  
063 ELECTRIC PLANT  
064 COMMAND AND SURVEILLANCE  
065 AUXILIARY SYSTEMS  
066 OUTFITTING  
067 WEAPONS  
068 INTEGRATION AND ENGINEERING  
069 SHIP ASSEMBLY

## SHIP WORK BREAKDOWN STRUCTURE TITLE

070 GENERAL REQUIREMENTS FOR DESIGN AND CONSTRUCTION  
071 ACCESS  
072 SHOCK  
073 NOISE AND VIBRATION  
074 CASTING ,WELDING,RIVETING,ALLIED PROCESSES (GENERAL)  
075 THREADED FASTENERS STANDARDS  
076 RELIABILITY AND MAINTAINABILITY  
077 SAFETY  
078 MATERIALS  
079 SEAWORTHINESS  
080 INTEGRATED LOGISTIC SUPPORT REQUIREMENTS  
081 MAINTENANCE  
082 SUPPORT AND TEST EQUIPMENT  
083 SUPPLY SUPPORT  
084 TRANSPORTATION AND HANDLING  
085 ENGINEERING DRAWINGS  
086 TECHNICAL MANUALS AND OTHER DATA  
087 FACILITIES  
088 PERSONNEL AND TRAINING  
089 TRAINING EQUIPMENT  
090 QUALITY ASSURANCE REQUIREMENTS  
091 SHIP INSPECTIONS  
092 SHIP TESTS  
093 COMBAT SYSTEMS CHECKOUT  
094 REGULAR SHIP TRIALS  
096 WEIGHT CONTROL  
097 INCLINING EXPERIMENT AND TRIM DIVE  
098 MODELS AND MOCKUPS  
099 PHOTOGRAPHS

**GROUP 1 HULL STRUCTURE**  
\*\*\*\*\*

|     |   |
|-----|---|
| 100 | HULL STRUCTURE, GENERAL _____ - _____                       |
| 101 | GENERAL ARRANGEMENT-STRUCTURAL DRAWINGS. _____ - _____      |
| 110 | SHELL AND SUPPORTING STRUCTURE _____ - _____                |
| 111 | SHELL PLATING, SURF. SHIP AND SUBMARINE PRESS. HULL _____   |
| 112 | SHELL PLATING, SUBMARINE NON-PRESSURE HULL _____ - _____    |
| 113 | INNER BOTTOM _____ - _____ - _____                          |
| 114 | SHELL APPENDAGES _____ - _____ - _____                      |
| 115 | STANCHIONS _____ - _____ - _____                            |
| 116 | LONGIT. FRAMING, SURF. SHIP AND SUBMARINE PRESS. HULL _____ |
| 117 | TRANSV. FRAMING, SURF. SHIP AND SUBMARINE PRESS. HULL _____ |
| 118 | LONGIT. AND TRANSV. SUBMARINE NON-PRESS. HULL FRAMING _____ |

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# SHIP WORK BREAKDOWN STRUCTURE TITLE

|     |   | CAMDAC | CAPDAC | CAYDAC | ELADAC | HANDAC | HULDAC |
|-----|---|--------|--------|--------|--------|--------|--------|
| 120 | HULL STRUCTURAL BULKHEADS                           |        |        |        |        |        |        |
| 121 | LONGITUDINAL STRUCTURAL BULKHEADS                   |        |        |        |        |        | X      |
| 122 | TRANSVERSE STRUCTURAL BULKHEADS                     |        |        |        |        |        | X      |
| 123 | TRUNKS AND ENCLOSURES                               |        |        |        |        |        | X      |
| 124 | BULKHEADS IN TORPEDO PROTECTION SYSTEM              |        |        |        |        |        | X      |
| 125 | SUBMARINE HARD TANKS                                |        |        |        |        |        | X      |
| 126 | SUBMARINE SOFT TANKS                                |        |        |        |        |        | X      |
| 130 | HULL DECKS  |        |        |        |        |        |        |
| 131 | MAIN DECK   |        |        |        |        |        | X      |
| 132 | 2ND DECK  |        |        |        |        |        | X      |
| 133 | 3RD DECK  |        |        |        |        |        | X      |
| 134 | 4TH DECK  |        |        |        |        |        | X      |
| 135 | 5TH DECK AND DECKS BELOW                            |        |        |        |        |        | X      |
| 136 | 01 HULL DECK (FORECASTLE AND POOP DECKS)            |        |        |        |        |        | X      |
| 137 | 02 HULL DECK  |        |        |        |        |        | X      |
| 138 | 03 HULL DECK  |        |        |        |        |        | X      |
| 139 | 04 HULL DECK AND HULL DECKS ABOVE                   |        |        |        |        |        | X      |
| 140 | HULL PLATFORMS AND FLATS                            |        |        |        |        |        |        |
| 141 | 1ST PLATFORM  |        |        |        |        |        | X      |
| 142 | 2ND PLATFORM  |        |        |        |        |        | X      |
| 143 | 3RD PLATFORM  |        |        |        |        |        | X      |
| 144 | 4TH PLATFORM  |        |        |        |        |        | X      |
| 145 | 5TH PLATFORM  |        |        |        |        |        | X      |
| 149 | FLATS   |        |        |        |        |        | X      |
| 150 | DECK HOUSE STRUCTURE                                |        |        |        |        |        |        |
| 151 | DECKHOUSE STRUCTURE TO FIRST LEVEL                  |        |        |        |        |        | X      |
| 152 | 1ST DECKHOUSE LEVEL                                 |        |        |        |        |        | X      |
| 153 | 2ND DECKHOUSE LEVEL                                 |        |        |        |        |        | X      |
| 154 | 3RD DECKHOUSE LEVEL                                 |        |        |        |        |        | X      |
| 155 | 4TH DECKHOUSE LEVEL                                 |        |        |        |        |        | X      |
| 156 | 5TH DECKHOUSE LEVEL                                 |        |        |        |        |        | X      |
| 157 | 6TH DECKHOUSE LEVEL                                 |        |        |        |        |        | X      |
| 158 | 7TH DECKHOUSE LEVEL                                 |        |        |        |        |        | X      |
| 159 | 8TH DECKHOUSE LEVEL AND ABOVE                       |        |        |        |        |        | X      |
| 160 | SPECIAL STRUCTURES                                  |        |        |        |        |        |        |
| 161 | STRUCTURAL CASTINGS, FORGINGS, AND EQUIV. WELDMENTS |        |        |        |        |        | X      |
| 162 | STACKS AND MACKS (COMBINED STACK AND MAST)          |        |        |        |        |        | X      |
| 163 | SEA CHESTS  |        |        |        |        |        | X      |
| 164 | BALLISTIC PLATING                                   |        |        |        |        |        | X      |
| 165 | SONAR DOMES   |        |        |        |        |        | X      |
| 166 | SPONSONS  |        |        |        |        |        | X      |
| 167 | HULL STRUCTURAL CLOSURES                            |        |        |        |        |        | X      |
| 168 | DECKHOUSE STRUCTURAL CLOSURES                       |        |        |        |        |        | X      |
| 169 | SPECIAL PURPOSE CLOSURES AND STRUCTURES             |        |        |        |        |        | X      |
| 170 | MASTS, KINGPOSTS, AND SERVICE PLATFORMS             |        |        |        |        |        | X      |
| 171 | MASTS, TOWERS, TETRAPODS                            |        |        |        |        |        | X      |
| 172 | KINGPOSTS AND SUPPORT FRAMES                        |        |        |        |        |        | X      |
| 179 | SERVICE PLATFORMS                                   |        |        |        |        |        | X      |

## SHIP WORK BREAKDOWN STRUCTURE TITLE

|                          |   | CAMDAC | CAPDAC | CAVDAC | ELXDAC | HANDAC | HULDAC |
|--------------------------|---|--------|--------|--------|--------|--------|--------|
| 180                      | FOUNDATIONS                                     |        |        |        |        |        |        |
| 181                      | HULL STRUCTURE FOUNDATIONS                      |        |        |        |        |        |        |
| 182                      | PROPULSION PLANT FOUNDATIONS                    |        |        |        |        |        |        |
| 183                      | ELECTRIC PLANT FOUNDATIONS                      |        |        |        |        |        |        |
| 184                      | COMMAND AND SURVEILLANCE FOUNDATIONS            |        |        |        |        |        |        |
| 185                      | AUXILIARY SYSTEMS FOUNDATIONS                   |        |        |        |        |        |        |
| 186                      | OUTFIT AND FURNISHINGS FOUNDATIONS              |        |        |        |        |        |        |
| 187                      | ARMAMENT FOUNDATIONS                            |        |        |        |        |        |        |
| 190                      | SPECIAL PURPOSE SYSTEMS                         |        |        |        |        |        |        |
| 191                      | BALLAST, FIXED OR FLUID, AND BUOYANCY UNITS     |        |        |        |        |        |        |
| 192                      | COMPARTMENT TESTING                             |        |        |        |        |        |        |
| 195                      | ERECTION OF SUB SECTIONS (PROGRESS REPORT ONLY) |        |        |        |        |        |        |
| 198                      | FREE FLOODING LIQUIDS                           |        |        |        |        |        |        |
| 199                      | HULL REPAIR PARTS AND SPECIAL TOOLS             |        |        |        |        |        |        |
| GROUP 2 PROPULSION PLANT |   |        |        |        |        |        |        |
| *****                    |   |        |        |        |        |        |        |
| 200                      | PROPULSION PLANT, GENERAL                       |        |        |        |        |        |        |
| 201                      | GENERAL ARRANGEMENT - PROPULSION DRAWINGS       |        |        |        |        |        |        |
| 202                      | AUTOMATED SHIP CONTROL SYSTEMS                  |        |        |        |        |        |        |
| 210                      | ENERGY GENERATING SYSTEM (NUCLEAR)              |        |        |        |        |        |        |
| 211                      | (RESERVED)                                      |        |        |        |        |        |        |
| 212                      | NUCLEAR STEAM GENERATOR                         |        |        |        |        |        |        |
| 213                      | REACTORS  |        |        |        |        |        |        |
| 214                      | REACTOR COOLANT SYSTEM                          |        |        |        |        |        |        |
| 215                      | REACTOR COOLANT SERVICE SYSTEM                  |        |        |        |        |        |        |
| 216                      | REACTOR PLANT AUXILIARY SYSTEMS                 |        |        |        |        |        |        |
| 217                      | NUCLEAR POWER CONTROL AND INSTRUMENTATION       |        |        |        |        |        |        |
| 218                      | RADIATION SHIELDING (PRIMARY)                   |        |        |        |        |        |        |
| 219                      | RADIATION SHIELDING (SECONDARY)                 |        |        |        |        |        |        |
| 220                      | ENERGY GENERATING SYSTEM (NON-NUCLEAR)          |        |        |        |        |        |        |
| 221                      | PROPULSION BOILERS                              |        |        |        |        |        |        |
| 222                      | GAS GENERATORS                                  |        |        |        |        |        |        |
| 223                      | MAIN PROPULSION BATTERIES                       |        |        |        |        |        |        |
| 224                      | MAIN PROPULSION FUEL CELLS                      |        |        |        |        |        |        |
| 230                      | PROPULSION UNITS                                |        |        |        |        |        |        |
| 231                      | PROPULSION STEAM TURBINES                       |        |        |        |        |        |        |
| 232                      | PROPULSION STEAM ENGINES                        |        |        |        |        |        |        |
| 233                      | PROPULSION INTERNAL COMBUSTION ENGINES          |        |        |        |        |        |        |
| 234                      | PROPULSION GAS TURBINES                         |        |        |        |        |        |        |
| 235                      | ELECTRIC PROPULSION                             |        |        |        |        |        |        |
| 236                      | SELF-CONTAINED PROPULSION SYSTEMS               |        |        |        |        |        |        |
| 237                      | AUXILIARY PROPULSION DEVICES                    |        |        |        |        |        |        |
| 238                      | SECONDARY PROPULSION (SUBMARINES)               |        |        |        |        |        |        |
| 239                      | EMERGENCY PROPULSION (SUBMARINES)               |        |        |        |        |        |        |

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## SHIP WORK BREAKDOWN STRUCTURE TITLE

|   | CAMDAC | CAPDAC | CAVDAC | ELVDAC | HANDAC | MULDAC |
|---|--------|--------|--------|--------|--------|--------|
| 340 POWER GENERATION SUPPORT SYSTEMS              |        |        |        |        |        |        |
| 341 SSTG LUBE OIL                                 |        |        |        | X      |        |        |
| 342 DIESEL SUPPORT SYSTEMS                        |        |        |        | X      |        |        |
| 343 TURBINE SUPPORT SYSTEMS                       |        |        |        | X      |        |        |
| 390 SPECIAL PURPOSE SYSTEMS                       |        |        |        |        |        |        |
| 398 ELECTRIC PLANT OPERATING FLUIDS               |        |        |        | X      |        |        |
| 399 ELECTRIC PLANT REPAIR PARTS AND SPECIAL TOOLS |        |        |        |        |        |        |

## GROUP 4 COMMAND AND SURVEILLANCE

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|   | CAMDAC | CAPDAC | CAVDAC | ELVDAC | HANDAC | MULDAC |
|---|--------|--------|--------|--------|--------|--------|
| 400 COMMAND AND SURVEILLANCE, GENERAL               |        |        |        |        |        |        |
| 401 GENERAL ARRANGEMENT - COMMAND AND SURVEILLANCE  |        |        |        |        |        |        |
| 402 SECURITY REQUIREMENTS                           |        |        |        |        |        |        |
| 403 PERSONNEL SAFETY                                |        |        |        |        |        |        |
| 404 RADIO FREQUENCY TRANSMISSION LINES              |        |        |        |        |        |        |
| 405 ANTENNA REQUIREMENTS                            |        |        |        |        |        |        |
| 406 GROUNDING AND BONDING                           |        |        |        |        |        |        |
| 407 ELECTROMAGNETIC INTERFERENCE REDUCTION (EMI)    |        |        |        |        |        |        |
| 408 SYSTEM TEST REQUIREMENTS                        |        |        |        |        |        |        |
| 410 COMMAND AND CONTROL SYSTEMS                     |        |        |        |        |        |        |
| 411 DATA DISPLAY GROUP                              |        |        |        | X      |        |        |
| 412 DATA PROCESSING GROUP                           |        |        |        | X      |        |        |
| 413 DIGITAL DATA SWITCHBOARDS                       |        |        |        | X      |        |        |
| 414 INTERFACE EQUIPMENT                             |        |        |        | X      |        |        |
| 415 DIGITAL DATA COMMUNICATIONS                     |        |        |        | X      |        |        |
| 416 COMMAND AND CONTROL TESTING                     |        |        |        | X      |        |        |
| 417 COMMAND AND CONTROL ANALOG SWITCHBOARDS         |        |        |        | X      |        |        |
| 420 NAVIGATION SYSTEMS                              |        |        |        |        |        |        |
| 421 NON-ELECTRICAL/ELECTRONIC NAVIGATION AIDS       |        |        |        | X      |        |        |
| 422 ELECTRICAL NAVIGATION AIDS (INCL NAVIG. LIGHTS) |        |        |        | X      |        |        |
| 423 ELECTRONIC NAVIGATION SYSTEMS, RADIO            |        |        |        | X      |        |        |
| 424 ELECTRONIC NAVIGATION SYSTEMS, ACOUSTICAL       |        |        |        | X      |        |        |
| 425 PERISCOPES                                      |        |        |        | X      |        |        |
| 426 ELECTRICAL NAVIGATION SYSTEMS                   |        |        |        | X      |        |        |
| 427 INERTIAL NAVIGATION SYSTEMS                     |        |        |        | X      |        |        |
| 430 INTERIOR COMMUNICATIONS                         |        |        |        |        |        |        |
| 431 SWITCHBOARDS FOR I.C. SYSTEMS                   |        |        |        | X      |        |        |
| 432 TELEPHONE SYSTEMS                               |        |        |        | X      |        |        |
| 433 ANNOUNCING SYSTEMS                              |        |        |        | X      |        |        |
| 434 ENTERTAINMENT AND TRAINING SYSTEMS              |        |        |        | X      |        |        |
| 435 VOICE TUBES AND MESSAGE PASSING SYSTEMS         |        |        |        | X      |        |        |
| 436 ALARM, SAFETY, AND WARNING SYSTEMS              |        |        |        | X      |        |        |
| 437 INDICATING, ORDER, AND METERING SYSTEMS         |        |        |        | X      |        |        |
| 438 INTEGRATED CONTROL SYSTEMS                      |        |        |        | X      |        |        |
| 439 RECORDING AND TELEVISION SYSTEMS                |        |        |        | X      |        |        |

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# SHIP WORK BREAKDOWN STRUCTURE TITLE

|                           |  | CAMBAC | CAPDAC | CAVDAC | ELKDAC | HANDAC | HULDAC |
|---------------------------|--|--------|--------|--------|--------|--------|--------|
| GROUP 5 AUXILIARY SYSTEMS |  |        |        |        |        |        |        |
| *****                     |  |        |        |        |        |        |        |
| 500                       | AUXILIARY SYSTEMS, GENERAL                     |        |        |        |        |        |        |
| 501                       | GENERAL ARRANGEMENT-AUXILIARY SYSTEMS DRAWINGS |        |        |        |        |        |        |
| 502                       | AUXILIARY MACHINERY                            |        |        |        |        |        |        |
| 503                       | PUMPS  |        |        |        |        |        |        |
| 504                       | INSTRUMENTS AND INSTRUMENT BOARDS              |        |        |        |        |        |        |
| 505                       | GENERAL PIPING REQUIREMENTS                    |        |        |        |        |        |        |
| 506                       | OVERFLOWS, AIR ESCAPES, AND SOUNDING TUBES     |        |        |        |        |        |        |
| 510                       | CLIMATE CONTROL                                |        |        |        |        |        |        |
| 511                       | COMPARTMENT HEATING SYSTEM                     |        |        |        |        |        |        |
| 512                       | VENTILATION SYSTEM                             |        |        |        |        |        |        |
| 513                       | MACHINERY SPACE VENTILATION SYSTEM             |        |        |        |        |        |        |
| 514                       | AIR CONDITIONING SYSTEM                        |        |        |        |        |        |        |
| 515                       | AIR REVITALIZATION SYSTEMS (SUBMARINES)        |        |        |        |        |        |        |
| 516                       | REFRIGERATION SYSTEM                           |        |        |        |        |        |        |
| 517                       | AUXILIARY BOILERS AND OTHER HEAT SOURCES       |        |        |        |        |        |        |
| 520                       | SEA WATER SYSTEMS                              |        |        |        |        |        |        |
| 521                       | FIREMAIN AND FLUSHING (SEA WATER) SYSTEM       |        |        |        |        |        |        |
| 522                       | SPRINKLER SYSTEM                               |        |        |        |        |        |        |
| 523                       | WASHDOWN SYSTEM                                |        |        |        |        |        |        |
| 524                       | AUXILIARY SEA WATER SYSTEM                     |        |        |        |        |        |        |
| 526                       | SCUPPERS AND DECK DRAINS                       |        |        |        |        |        |        |
| 527                       | FIREMAIN ACTUATED SERVICES - OTHER             |        |        |        |        |        |        |
| 528                       | PLUMBING DRAINAGE                              |        |        |        |        |        |        |
| 529                       | DRAINAGE AND BALLASTING SYSTEM                 |        |        |        |        |        |        |
| 530                       | FRESH WATER SYSTEMS                            |        |        |        |        |        |        |
| 531                       | DISTILLING PLANT                               |        |        |        |        |        |        |
| 532                       | COOLING WATER                                  |        |        |        |        |        |        |
| 533                       | POTABLE WATER                                  |        |        |        |        |        |        |
| 534                       | AUX. STEAM AND DRAINS WITHIN MACHINERY BOX     |        |        |        |        |        |        |
| 535                       | AUX. STEAM AND DRAINS OUTSIDE MACHINERY BOX    |        |        |        |        |        |        |
| 536                       | AUXILIARY FRESH WATER COOLING                  |        |        |        |        |        |        |
| 540                       | FUELS AND LUBRICANTS, HANDLING AND STORAGE     |        |        |        |        |        |        |
| 541                       | SHIP FUEL AND FUEL COMPENSATING SYSTEM         |        |        |        |        |        |        |
| 542                       | AVIATION AND GENERAL PURPOSE FUELS             |        |        |        |        |        |        |
| 543                       | AVIATION AND GENERAL PURPOSE LUBRICATING OIL   |        |        |        |        |        |        |
| 544                       | LIQUID CARGO                                   |        |        |        |        |        |        |
| 545                       | TANK HEATING                                   |        |        |        |        |        |        |
| 550                       | AIR, GAS, AND MISC. FLUID SYSTEMS              |        |        |        |        |        |        |
| 551                       | COMPRESSED AIR SYSTEMS                         |        |        |        |        |        |        |
| 552                       | COMPRESSED GASES                               |        |        |        |        |        |        |
| 553                       | O2 N2 SYSTEM                                   |        |        |        |        |        |        |
| 554                       | LP BLOW  |        |        |        |        |        |        |
| 555                       | FIRE EXTINGUISHING SYSTEMS                     |        |        |        |        |        |        |
| 556                       | HYDRAULIC FLUID SYSTEM                         |        |        |        |        |        |        |
| 557                       | LIQUID GASES, CARGO                            |        |        |        |        |        |        |
| 558                       | SPECIAL PIPING SYSTEMS                         |        |        |        |        |        |        |

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## SHIP WORK BREAKDOWN STRUCTURE TITLE

|     |  | CAMDAC | CAPDAC | CAYDAC | ELADAC | HANDAC | MULDAC |
|-----|--|--------|--------|--------|--------|--------|--------|
| 620 | HULL COMPARTMENTATION                                    |        |        |        |        |        |        |
| 621 | NON-STRUCTURAL BULKHEADS                                 |        |        |        |        |        |        |
| 622 | FLOOR PLATES AND GRATINGS                                |        |        |        |        |        |        |
| 623 | LADDERS  |        |        |        |        |        |        |
| 624 | NON-STRUCTURAL CLOSURES                                  |        |        |        |        |        |        |
| 625 | AIRPORTS, FIXED PORTLIGHTS, AND WINDOWS                  |        |        |        |        |        |        |
| 630 | PRESERVATIVES AND COVERINGS                              |        |        |        |        |        |        |
| 631 | PAINTING   |        |        |        |        |        |        |
| 632 | ZINC COATING   |        |        |        |        |        |        |
| 633 | CATHODIC PROTECTION                                      |        |        |        |        |        |        |
| 634 | DECK COVERING  |        |        |        |        |        |        |
| 635 | HULL INSULATION  |        |        |        |        |        |        |
| 636 | HULL DAMPING   |        |        |        |        |        |        |
| 637 | SHEATHING  |        |        |        |        |        |        |
| 638 | REFRIGERATED SPACES                                      |        |        |        |        |        |        |
| 639 | RADIATION SHIELDING                                      |        |        |        |        |        |        |
| 640 | LIVING SPACES  |        |        |        |        |        |        |
| 641 | OFFICER BERTHING AND MESSING SPACES                      |        |        |        |        |        |        |
| 642 | NONCOMMISSIONED OFFICER BERTHING AND MESSING SPACES      |        |        |        |        |        |        |
| 643 | ENLISTED PERSONNEL BERTHING AND MESSING SPACES           |        |        |        |        |        |        |
| 644 | SANITARY SPACES AND FIXTURES                             |        |        |        |        |        |        |
| 645 | LEISURE AND COMMUNITY SPACES                             |        |        |        |        |        |        |
| 650 | SERVICE SPACES   |        |        |        |        |        |        |
| 651 | COMMISSARY SPACES  |        |        |        |        |        |        |
| 652 | MEDICAL SPACES   |        |        |        |        |        |        |
| 653 | DENTAL SPACES  |        |        |        |        |        |        |
| 654 | UTILITY SPACES   |        |        |        |        |        |        |
| 655 | LAUNDRY SPACES   |        |        |        |        |        |        |
| 656 | TRASH DISPOSAL SPACES                                    |        |        |        |        |        |        |
| 660 | WORKING SPACES   |        |        |        |        |        |        |
| 661 | OFFICES  |        |        |        |        |        |        |
| 662 | MACHINERY CONTROL CENTERS FURNISHINGS                    |        |        |        |        |        |        |
| 663 | ELECTRONICS CONTROL CENTERS FURNISHINGS                  |        |        |        |        |        |        |
| 664 | DAMAGE CONTROL STATIONS                                  |        |        |        |        |        |        |
| 665 | WORKSHOPS, LABS, TEST AREAS (INCL PORTABLE TOOLS, EQUIP) |        |        |        |        |        |        |
| 670 | STOWAGE SPACES   |        |        |        |        |        |        |
| 671 | LOCKERS AND SPECIAL STOWAGE                              |        |        |        |        |        |        |
| 672 | STOREROOMS AND ISSUE ROOMS                               |        |        |        |        |        |        |
| 673 | CARGO STOWAGE  |        |        |        |        |        |        |
| 690 | SPECIAL PURPOSE SYSTEMS                                  |        |        |        |        |        |        |
| 698 | OUTFIT AND FURNISHINGS OPERATING FLUIDS                  |        |        |        |        |        |        |
| 699 | OUTFIT AND FURNISH. REPAIR PARTS AND SPECIAL TOOLS       |        |        |        |        |        |        |

## SHIP WORK BREAKDOWN STRUCTURE TITLE

**GROUP 7 ARMAMENT**

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|     |  |
|-----|--|
| 700 | ARMAMENT, GENERAL _____                                    |
| 701 | GENERAL ARRANGEMENT - WEAPONRY SYSTEMS _____               |
| 702 | ARMAMENT INSTALLATIONS _____                               |
| 703 | WEAPONS HANDLING AND STOWAGE, GENERAL _____                |
| 710 | GUNS AND AMMUNITION _____                                  |
| 711 | GUNS _____   |
| 712 | AMMUNITION HANDLING _____                                  |
| 713 | AMMUNITION STOWAGE _____                                   |
| 720 | MISSILES AND ROCKETS _____                                 |
| 721 | LAUNCHING DEVICES (MISSILES AND ROCKETS) _____             |
| 722 | MISSILE, ROCKET, AND GUIDANCE CAPSULE HANDLING SYS. _____  |
| 723 | MISSILE AND ROCKET STOWAGE _____                           |
| 724 | MISSILE HYDRAULICS _____                                   |
| 725 | MISSILE GAS _____  |
| 726 | MISSILE COMPENSATING _____                                 |
| 727 | MISSILE ENVIRONMENTAL MONITORING AND LAUNCHER CONTR. _____ |
| 728 | MISSILE HEATING, COOLING, TEMPERATURE CONTROL _____        |
| 730 | MINES _____  |
| 731 | MINE LAUNCHING DEVICES _____                               |
| 732 | MINE HANDLING _____  |
| 733 | MINE STOWAGE _____   |
| 740 | DEPTH CHARGES _____  |
| 741 | DEPTH CHARGE LAUNCHING DEVICES _____                       |
| 742 | DEPTH CHARGE HANDLING _____                                |
| 743 | DEPTH CHARGE STOWAGE _____                                 |
| 750 | TORPEDOES _____  |
| 751 | TORPEDO TUBES _____  |
| 752 | TORPEDO HANDLING _____                                     |
| 753 | TORPEDO STOWAGE _____                                      |
| 754 | SUBMARINE TORPEDO EJECTION _____                           |
| 760 | SMALL ARMS AND PYROTECHNICS _____                          |
| 761 | SMALL ARMS AND PYROTECHNIC LAUNCHING DEVICES _____         |
| 762 | SMALL ARMS AND PYROTECHNIC HANDLING _____                  |
| 763 | SMALL ARMS AND PYROTECHNIC STOWAGE _____                   |
| 770 | CARGO MUNITIONS _____                                      |
| 772 | CARGO MUNITIONS HANDLING _____                             |
| 773 | CARGO MUNITIONS STOWAGE _____                              |
| 780 | AIRCRAFT RELATED WEAPONS _____                             |
| 782 | AIRCRAFT RELATED WEAPONS HANDLING _____                    |
| 783 | AIRCRAFT RELATED WEAPONS STOWAGE _____                     |
| 790 | SPECIAL PURPOSE SYSTEMS _____                              |
| 792 | SPECIAL WEAPONS HANDLING _____                             |
| 793 | SPECIAL WEAPONS STOWAGE _____                              |
| 797 | MISC. ORDNANCE SPACES _____                                |
| 798 | ARMAMENT OPERATING FLUIDS _____                            |
| 799 | ARMAMENT REPAIR PARTS AND SPECIAL TOOLS _____              |

# SHIP WORK BREAKDOWN STRUCTURE TITLE

|  |  | CAMDAC | CAPDAC | CAVDAC | ELKDAC | HANDAC | HULDAC |
|--|--|--------|--------|--------|--------|--------|--------|
| GROUP 8 INTEGRATION/ENGINEERING (SHIPBUILDER RESPONSE) |  |        |        |        |        |        |        |
| *****  |  |        |        |        |        |        |        |
| 800  | INTEGRATION/ENGINEERING(SHIPBUILDER RESPONSE)        |        |        |        |        |        |        |
| 801  | SHIPBUILDERS INFORMATION DRAWINGS                    |        |        |        |        |        | X      |
| 802  | CONTRACT DRAWINGS                                    |        |        |        |        |        |        |
| 803  | STANDARD DRAWINGS                                    |        |        |        |        |        |        |
| 804  | TYPE DRAWINGS  |        |        |        |        |        |        |
| 806  | STUDY DRAWINGS                                       |        |        |        |        |        |        |
| 810  | PRODUCTION ENGINEERING                               |        |        |        |        |        |        |
| 811  | CONFIGURATION MANAGEMENT                             |        |        |        |        |        |        |
| 812  | CHANGE PROPOSALS, SCOPING AND SHIPCHECKING           |        |        |        |        |        |        |
| 813  | PLANNING AND PRODUCTION CONTROL                      |        |        |        |        |        |        |
| 820  | SPECIAL DRAWINGS FOR NUCLEAR PROPULSION SYSTEMS      |        |        |        |        |        |        |
| 830  | DESIGN SUPPORT                                       |        |        |        |        |        |        |
| 831  | CONSTRUCTION DRAWINGS                                |        |        |        |        |        |        |
| 832  | SPECIFICATIONS                                       |        |        |        |        |        |        |
| 833  | WEIGHT ENGINEERING                                   |        |        |        |        |        | X      |
| 834  | COMPUTER PROGRAMS                                    |        |        |        |        |        |        |
| 835  | ENGINEERING CALCULATIONS                             |        |        |        |        |        |        |
| 836  | MODELS AND MOCKUPS                                   |        |        |        |        |        |        |
| 837  | PHOTOGRAPHS  |        |        |        |        |        |        |
| 838  | DESIGN/ENGINEERING LIAISON                           |        |        |        |        |        |        |
| 839  | LOFTING  |        |        |        |        |        |        |
| 840  | QUALITY ASSURANCE                                    |        |        |        |        |        |        |
| 841  | TESTS AND INSPECTION, CRITERIA, AND PROCEDURES       |        |        |        |        |        |        |
| 842  | TRIALS AGENDA PREPARATION, DATA COLLECTION AND ANAL. |        |        |        |        |        |        |
| 843  | INCLINING EXPERIMENT AND TRIM DIVE                   |        |        |        |        |        | X      |
| 844  | COMBAT SYSTEMS CHECKOUT CRITERIA AND PROCEDURES      |        |        |        | X      |        |        |
| 845  | CERTIFICATION STANDARDS                              |        |        |        |        |        |        |
| 850  | INTEGRATED LOGISTIC SUPPORT ENGINEERING              |        |        |        |        |        |        |
| 851  | MAINTENANCE  |        |        |        |        |        |        |
| 852  | SUPPORT AND TEST EQUIPMENT                           |        |        |        |        |        |        |
| 853  | SUPPLY SUPPORT                                       |        |        |        |        |        |        |
| 854  | TRANSPORTATION                                       |        |        |        |        |        |        |
| 855  | ENGINEERING DRAWINGS AND SPECIFICATIONS              |        |        |        |        |        |        |
| 856  | TECHNICAL MANUALS AND OTHER DATA                     |        |        |        |        |        |        |
| 857  | FACILITIES   |        |        |        |        |        |        |
| 858  | PERSONNEL AND TRAINING                               |        |        |        |        |        |        |
| 859  | TRAINING EQUIPMENT                                   |        |        |        |        |        |        |
| 890  | SPECIAL PURPOSE ITEMS                                |        |        |        |        |        |        |
| 891  | SAFETY   |        |        |        |        |        |        |
| 892  | HUMAN FACTORS  |        |        |        |        |        |        |
| 893  | STANDARDIZATION                                      |        |        |        |        |        |        |
| 894  | VALUE ENGINEERING                                    |        |        |        |        |        |        |
| 895  | RELIABILITY AND MAINTAINABILITY                      |        |        |        |        |        |        |
| 896  | DATA MANAGEMENT                                      |        |        |        |        |        |        |
| 897  | PROJECT MANAGEMENT                                   |        |        |        |        |        |        |

# SHIP WORK BREAKDOWN STRUCTURE TITLE

| GROUP 9 SHIP ASSEMBLY AND SUPPORT SERVICES<br>***** |  | CAMDAC | CAPDAC | CAVDAC | ELKDAC | HANDAC | HULDAC |
|---|--|--------|--------|--------|--------|--------|--------|
| 900   | SHIP ASSEMBLY AND SUPPORT SERVICES                   |        |        |        |        |        |        |
| 901   | 901 THRU 979 RESERVED FOR IDENT. OF ASSEMBLIES       |        |        |        |        |        |        |
| 980   | CONTRACTUAL AND PRODUCTION SUPPORT SERVICE           |        |        |        |        |        |        |
| 981   | INSURANCE  |        |        |        |        |        |        |
| 982   | TRIALS   |        |        |        |        |        |        |
| 983   | DELIVERY   |        |        |        |        |        |        |
| 984   | OPEN AND INSPECT (CONVERSIONS ONLY)                  |        |        |        |        |        |        |
| 985   | FIRE AND FLOODING PROTECTION                         |        |        |        |        |        |        |
| 986   | TESTS AND INSPECTION                                 |        |        |        |        |        |        |
| 987   | WEIGHING AND RECORDING                               |        |        |        |        |        |        |
| 988   | CONTRACT DATA REQUIREMENTS (ADMINISTRATION)          |        |        |        |        |        |        |
| 989   | FITTING-OUT  |        |        |        |        |        |        |
| 990   | CONSTRUCTION SUPPORT                                 |        |        |        |        |        |        |
| 991   | STAGING, SCAFFOLDING, AND CRIBBING                   |        |        |        |        |        |        |
| 992   | TEMPORARY UTILITIES AND SERVICES                     |        |        |        |        |        |        |
| 993   | MATERIAL HANDLING AND REMOVAL                        |        |        |        |        |        |        |
| 994   | CLEANING SERVICES                                    |        |        |        |        |        |        |
| 995   | MOLDS AND TEMPLATES, JIGS, FIXTURES, AND SPEC. TOOLS |        |        |        |        |        |        |
| 996   | LAUNCHING  |        |        |        |        |        |        |
| 997   | DRYDOCKING   |        |        |        |        |        |        |



**APPENDIX D**

**I/O MATRIX**

# CASDAC LEVEL IV I/O MATRIX

1 - INPUT COMES FROM  
0 - OUTPUT GOES TO

|  | MCT.<br>SYSTEM<br>IV | CASDAC<br>IV | HULDAC<br>IV | CAPDAC<br>IV | ELXDAC<br>IV | HANDAC<br>IV | CAVDAC<br>IV | DESIGN<br>INTEG.<br>IV |
|--|----------------------|--------------|--------------|--------------|--------------|--------------|--------------|------------------------|
|  |                      |              |              |              |              |              |              |                        |
| 4  | 4.1                  | 4.2          | 4.3          | 4.4          | 4.5          | 4.6          | 4.7          | 4.8                    |
| CASDAC LEVEL IV  |                      |              |              |              |              |              |              |                        |
| LEVEL IV MANAGEMENT SYSTEM   |                      |              |              |              |              |              |              |                        |
| CASDAC IV  |                      |              |              |              |              |              |              |                        |
| MACHINERY LIST   |                      |              |              |              |              |              |              |                        |
| 4.2.1  |                      |              |              |              |              |              |              |                        |
| MACHINERY LIST PROPULSION PLANT  |                      |              |              |              |              |              |              |                        |
| 4.2.1.1  |                      |              |              |              |              |              |              |                        |
| COMPONENTS OF STEAM PLANTS   |                      |              |              |              |              |              |              |                        |
| 4.2.1.1.1  |                      |              |              |              |              |              |              |                        |
| .2   |                      |              |              |              |              |              |              |                        |
| COMPONENTS OF DIESEL PLANTS  |                      |              |              |              |              |              |              |                        |
| .3   |                      |              |              |              |              |              |              |                        |
| COMPONENTS OF GAS TURBINE PLANTS   |                      |              |              |              |              |              |              |                        |
| .4   |                      |              |              |              |              |              |              |                        |
| COMPONENTS ASSOCIATED WITH POWER TRANSMISSION  |                      |              |              |              |              |              |              |                        |
| .5   |                      |              |              |              |              |              |              |                        |
| COMPONENTS ASSOCIATED WITH AUXILIARY, SECONDARY, AND<br>EMERGENCY PROPULSION SYSTEMS |                      |              |              |              |              |              |              |                        |
| .6   |                      |              |              |              |              |              |              |                        |
| PROPULSION CONTROL   |                      |              |              |              |              |              |              |                        |
| 4.2.1.2  |                      |              |              |              |              |              |              |                        |
| MACHINERY LIST AUXILIARY SYSTEM  |                      |              |              |              |              |              |              |                        |
| 4.2.1.2.1  |                      |              |              |              |              |              |              |                        |
| MACHINERY LIST REFRIGERATION AND AIR-CONDITIONED PLANTS                              |                      |              |              |              |              |              |              |                        |
| 4.2.1.2.2  |                      |              |              |              |              |              |              |                        |
| MACHINERY LIST DISTILLING PLANT  |                      |              |              |              |              |              |              |                        |
| 4.2.1.2.3  |                      |              |              |              |              |              |              |                        |
| MACHINERY LIST AUXILIARY BOILER  |                      |              |              |              |              |              |              |                        |

CASDAC LEVEL IV I/O MATRIX

|  | MGT.<br>SYSTEM<br>IV | CANDAC<br>IV | MULDAC<br>IV | CAPDAC<br>IV | ELXDAC<br>IV | MANDAC<br>IV | CAVDAC<br>IV | DESIGN<br>INTEG.<br>IV |
|--|----------------------|--------------|--------------|--------------|--------------|--------------|--------------|------------------------|
|  |                      |              |              |              |              |              |              |                        |
| 4.2.1.2.4  | 4.1                  | 4.2          | 4.3          | 4.4          | 4.5          | 4.6          | 4.7          | 4.8                    |
| MACHINERY LIST O <sub>2</sub> N <sub>2</sub> PLANT             |                      |              |              |              | 1            |              |              |                        |
| 4.2.1.2.5  |                      |              |              |              | 1            |              |              |                        |
| MACHINERY LIST STEERING GEAR                                   |                      |              |              |              | 1            |              |              |                        |
| 4.2.1.3  |                      | 1            |              |              | 1            |              |              |                        |
| MACHINERY LIST ELECTRICAL SYSTEM SUPPORT                       |                      |              |              |              | 1            |              |              |                        |
| 4.2.1.3.1  |                      |              |              |              | 1            |              |              |                        |
| MACHINERY LIST SHIP SERVICE GENERATOR SYSTEM SUPPORT           |                      |              |              |              | 1            |              |              |                        |
| 4.2.1.3.2  |                      |              |              |              | 1            |              |              |                        |
| MACHINERY LIST EMERGENCY SHIP SERVICE GENERATOR SYSTEM SUPPORT |                      |              |              |              | 1            |              |              |                        |
| 4.2.2  | 0                    |              |              |              |              |              |              |                        |
| PURCHASE SPECIFICATIONS  |                      |              |              |              |              |              |              |                        |
| 4.2.3  | 1 0                  |              |              |              | 1            |              |              |                        |
| ARRANGEMENT DRAWINGS   |                      |              |              |              |              |              |              |                        |
| 4.2.3.1  | 1                    |              | 1            | 1            | 1 0          |              | 1 0          |                        |
| MACHINERY ARRANGEMENT DRAWINGS                                 |                      |              |              |              |              |              |              |                        |
| 4.2.3.2  | 1 0                  |              | 1            |              |              |              |              |                        |
| COMBUSTION AIR AND UPTAKES                                     |                      |              |              |              |              |              |              |                        |
| 4.2.3.3  | 1 0                  |              | 1            |              |              |              |              |                        |
| CONDENSER SCOOP  |                      |              |              |              |              |              |              |                        |
| 4.2.4  | 1 0                  |              | 1            |              |              |              |              |                        |
| DETAIL MACHINERY DRAWINGS                                      |                      |              |              |              | 0            |              |              |                        |
| 4.2.5  | 1 0                  |              |              |              |              |              |              |                        |
| EQUIPMENT OPERATING INSTRUCTIONS AND SAFETY PRECAUTIONS        |                      |              |              |              |              |              |              |                        |
| 4.2.6  | 1 0                  |              |              |              |              |              |              |                        |
| PLANT AND ENGINEERING SYSTEM INSTRUCTIONS                      |                      |              |              |              |              |              |              |                        |
| 4.2.7  | 1 0                  |              |              |              |              |              |              |                        |
| LABEL PLATES   |                      |              |              |              |              |              |              |                        |
| 4.2.8  | 0                    |              |              |              |              |              |              |                        |
| SCHEDULED MAINTENANCE INSTRUCTIONS                             |                      |              |              |              |              |              |              |                        |
| 4.2.9  | 0                    |              | 0            |              |              |              |              |                        |
| TEST SPECIFICATIONS  |                      |              |              |              |              |              |              |                        |
| 4.2.10   |                      |              |              |              |              |              |              |                        |
| PARTS ALLOWANCE LIST   |                      |              |              |              |              |              |              |                        |

# CASDAC LEVEL IV I/O MATRIX

|  | MGT.<br>SYSTEM<br>IV | CAMDAC<br>IV | HULDAC<br>IV | CAPDAC<br>IV | ELXDAC<br>IV | HANDAC<br>IV | CAVDAC<br>IV | DESIGN<br>INTG.<br>IV |
|--|----------------------|--------------|--------------|--------------|--------------|--------------|--------------|-----------------------|
|  |                      |              |              |              |              |              |              |                       |
| 4.3  | 4.1                  | 4.2          | 4.3          | 4.4          | 4.5          | 4.6          | 4.7          | 4.8                   |
| HULDAC LEVEL IV                              | 1 0                  | 1 0          | 1            | 1 0          | 1 0          | 1 0          | 1 0          |                       |
| 4.3.1 HULL SYSTEMS ENGINEERING               |                      |              | 1            |              | 1 0          |              |              |                       |
| 4.3.1.1 STRUCTURAL ENGINEERING               |                      |              | 1 0          | 1            |              |              | 0            |                       |
| 4.3.1.1.1 STRUCTURAL ENGINEERING ANALYSIS    |                      |              |              |              |              |              |              |                       |
| 4.3.1.1.2 FAIR MOLDED LINES                  |                      |              |              |              |              |              |              |                       |
| 4.3.1.1.3 STRUCTURAL ARRANGEMENT             |                      |              |              |              |              |              |              |                       |
| 4.3.1.1.4 DEVELOP SUPERSTRUCTURE             |                      |              |              |              |              |              |              |                       |
| 4.3.1.1.5 DETERMINE STRUCTURAL MATERIAL LIST |                      |              |              |              |              |              |              |                       |
| 4.3.1.2 DEVELOP C&A                          | 1 0                  | 1 0          | 1 0          | 1            | 1            |              | 1 0          |                       |
| 4.3.1.3 WEIGHT CONTROL                       | 0                    |              |              |              | 0            |              | 0            |                       |
| 4.3.1.4 NAVAL ARCHITECTURAL CALCULATIONS     | 1 0                  |              |              |              |              |              |              |                       |
| 4.3.1.4.1 CROSS-FLOODING ANALYSIS            |                      |              |              |              |              |              |              |                       |
| 4.3.1.4.2 HYDRODYNAMIC CALCULATIONS          |                      |              |              |              |              |              |              |                       |
| 4.3.1.4.3 LAUNCHING CALCULATIONS             |                      |              |              |              |              |              |              |                       |
| 4.3.1.4.4 DOCKING PLAN                       |                      |              |              |              |              |              |              |                       |
| 4.3.2 HULL DETAIL DESIGN                     | 0                    | 0            | 0            |              | 1            |              |              |                       |
| 4.3.2.1 STRUCTURAL DETAIL DESIGN             | 1 0                  | 1 0          | 1            | 1            | 1 0          |              | 1 0          |                       |

CASDAC LEVEL IV I/O MATRIX

|   | MGT.<br>SYSTEM<br>IV | CASDAC<br>IV | HULDAC<br>IV | CAPDAC<br>IV | ELXDAC<br>IV | HANDAC<br>IV | CAVDAC<br>IV | DESIGN<br>INTEG.<br>IV |
|---|----------------------|--------------|--------------|--------------|--------------|--------------|--------------|------------------------|
|   |                      |              |              |              |              |              |              |                        |
| 4.3.2.1.1 DECKS, PLATFORMS, MAIN BULKHEADS AND FRAMING DESIGN | 4.1                  | 4.2          | 4.3          | 4.4          | 4.5          | 4.6          | 4.7          | 4.8                    |
|   |                      | 1 0          |              |              | 1            |              |              |                        |
| 4.3.2.1.2 STRUCTURAL DECK HOUSE DETAIL DESIGN                 |                      | 1 0          |              |              |              |              |              |                        |
| 4.3.2.1.3 MISCELLANEOUS STRUCTURAL BULKHEADS                  |                      | 1 0          |              |              |              |              |              |                        |
| 4.3.2.1.4 HULL APPENDAGES DESIGN                              |                      |              |              |              |              |              |              |                        |
| 4.3.2.1.5 MAST, RAS, FAS DESIGN                               |                      |              |              |              | 1 0          |              |              |                        |
| 4.3.2.2 FOUNDATION DESIGN                                     |                      | 0            | 0            |              | 1 0          |              | 0            |                        |
| 4.3.2.3 HULL DETAIL ARRANGEMENTS                              |                      |              |              |              | 0            |              | 1 0          |                        |
| 4.3.2.3.1 DETAIL EQUIPMENT T ARRANGEMENTS                     |                      |              |              |              |              |              |              |                        |
| 4.3.2.3.2 DEVELOP DECK ARRANGEMENT DESIGN CONTROL DRAWINGS    |                      |              |              |              |              |              |              |                        |
| 4.3.2.4 MISCELLANEOUS HULL DETAILS                            |                      | 1            | 1            |              |              |              | 1 0          |                        |
| 4.3.2.5 VENDOR DRAWING APPROVAL                               |                      |              |              |              |              |              |              |                        |
| 4.4 CAPDAC IV   |                      | 1 0          | 0            | 1 0          | 1 0          |              | 1 0          |                        |
| 4.4.1 PIPING DIAGRAM  |                      | 1 0          |              | 1            | 0            |              |              |                        |
| 4.4.2 COMPOSITE DRAWINGS                                      |                      |              |              | 1 0          | 1 0          |              | 1 0          |                        |
| 4.4.3 ARRANGEMENT DRAWINGS                                    |                      |              |              | 1 0          | 1            |              | 0            |                        |
| 4.4.4 MATERIAL CONTROL  |                      | 0            |              | 1 0          |              |              |              |                        |
| 4.4.5 QUALITY ASSURANCE DRAWINGS                              |                      |              |              | 1 0          |              |              |              |                        |

# CASDAC LEVEL IV I/O MATRIX

|   | MGT.<br>SYSTEM<br>IV | CANDAC<br>IV | HULDAC<br>IV | CAPDAC<br>IV | ELXDAC<br>IV | HANDAC<br>IV | CAVDAC<br>IV | DESIGN<br>INTEG.<br>IV |
|---|----------------------|--------------|--------------|--------------|--------------|--------------|--------------|------------------------|
| 4.4.6                                   | 4.4.1                | 4.4.2        | 4.4.3        | 4.4.4        | 4.4.5        | 4.4.6        | 4.4.7        | 4.4.8                  |
| PIPE DETAILS                            |                      | 0            |              |              |              |              |              |                        |
| 4.4.7                                   |                      | 0            |              |              |              |              |              |                        |
| PIPE HANGER DRAWINGS                    |                      |              |              |              |              |              |              |                        |
| 4.4.8                                   |                      | 0            |              |              |              |              |              |                        |
| OPERATING GEAR DRAWINGS                 |                      |              |              |              |              |              |              |                        |
| 4.4.9                                   |                      | 0            |              |              |              |              |              |                        |
| LABEL PLATE DRAWINGS                    |                      |              |              |              |              |              |              |                        |
| 4.4.10                                  |                      | 0            |              |              |              |              |              |                        |
| TEST SPECIFICATIONS                     |                      |              |              |              |              |              |              |                        |
| 4.4.11                                  |                      | 0            |              |              |              |              |              |                        |
| HOSE AND LOCK LISTS                     |                      |              |              |              |              |              |              |                        |
| 4.5                                     |                      | 1 0          | 1 0          | 1 0          | 1 0          | 1 0          | 1 0          |                        |
| ELXDAC LEVEL IV                         |                      |              |              |              |              |              |              |                        |
| 4.5.1                                   |                      | 1 0          | 1 0          | 1 0          | 1 0          | 1 0          | 1 0          |                        |
| ARRANGEMENTS                            |                      |              |              |              |              |              |              |                        |
| 4.5.1.1                                 |                      | 1 0          | 1 0          | 1 0          | 1 0          | 1 0          | 1 0          |                        |
| ARRANGEMENTS OF MAJOR ELECTRONIC SPACES |                      |              |              |              |              |              |              |                        |
| 4.5.1.2                                 |                      |              | 1 0          |              | 1            |              |              |                        |
| ANTENNA ARRANGEMENT                     |                      |              | 0            |              | 1            |              |              |                        |
| 4.5.1.3                                 |                      |              |              |              |              |              |              |                        |
| RUNNING LIGHTS ARRANGEMENTS             |                      |              |              |              | 0            |              |              |                        |
| 4.5.1.4                                 |                      |              | 1            |              | 0            |              |              |                        |
| ELECTRICAL COMPOSITE DECK PLANS         |                      |              |              |              |              |              |              |                        |
| 4.5.2                                   |                      | 0            | 1 0          | 0            | 1 0          | 1 0          | 1 0          |                        |
| DRAWINGS AND LIST OF MATERIAL           |                      |              |              |              |              |              |              |                        |
| 4.5.2.1                                 |                      |              |              |              | 1 0          |              |              |                        |
| SCHEMATIC DRAWINGS                      |                      |              |              |              |              |              |              |                        |
| 4.5.2.2                                 |                      |              | 1            |              | 1 0          |              |              |                        |
| ELEMENTARY DRAWINGS                     |                      |              |              |              |              |              |              |                        |
| 4.5.2.3                                 |                      | 1            | 0            | 1 0          | 1 0          |              | 1            |                        |
| ISOMETRIC DRAWINGS AND LIST OF MATERIAL |                      |              |              |              |              |              |              |                        |
| 4.5.2.4                                 |                      |              |              |              | 1 0          |              |              |                        |
| HOOK-UP LIST                            |                      |              |              |              |              |              |              |                        |

# CASDAC LEVEL IV I/O MATRIX

|         | MGT.  |     | CAMDAC |     | HULDAC |    | CAPDAC |     | ELXDAC |    | HANDAC |     | CAVDAC |    | DESIGN |    |
|---------|---|-----|--------|-----|--------|----|--------|-----|--------|----|--------|-----|--------|----|--------|----|
|         | SYSTEM  | IV  | IV     | IV  | IV     | IV | IV     | IV  | IV     | IV | IV     | IV  | IV     | IV | IV     | IV |
| 4.5.2.5 | TELEPHONE DIRECTORY                                     | 4.1 | 4.2    | 4.3 |        |    | 4.4    | 4.5 | 1 0    |    | 4.6    | 4.7 | 4.8    |    |        |    |
| 4.5.2.6 | STANDARD METHODS DRAWING                                |     |        |     |        |    |        | 0   |        |    |        |     |        |    |        |    |
| 4.5.2.7 | DESIGN DIVISION INSTRUCTIONS                            |     | 1      | 1   |        |    | 1      | 1 0 |        |    |        |     | 1      |    |        |    |
| 4.5.3   | PERFORM SYSTEM ANALYSIS AND CALCULATIONS                |     |        |     |        |    |        | 1 0 |        |    |        |     | 1      |    |        |    |
| 4.5.3.1 | FAULT CURRENT   |     |        |     |        |    |        | 1 0 |        |    |        |     |        |    |        |    |
| 4.5.3.2 | VOLTAGE DROPS   |     |        |     |        |    |        | 1 0 |        |    |        |     |        |    |        |    |
| 4.5.3.3 | SYNCHRO LOADS   |     |        |     |        |    |        | 1 0 |        |    |        |     |        |    |        |    |
| 4.5.3.4 | SIZING  |     |        |     |        |    |        | 1 0 |        |    |        |     |        |    |        |    |
| 4.5.3.5 | LOAD BALANCING SUMMARIES                                |     |        |     |        |    |        | 1 0 |        |    |        |     |        |    |        |    |
| 4.5.3.6 | LOAD SHEDDING   |     |        |     |        |    |        | 1 0 |        |    |        |     |        |    |        |    |
| 4.5.3.7 | LIGHTING SURVEYS  |     |        |     |        |    |        | 1 0 |        |    |        |     |        |    |        |    |
| 4.5.3.8 | HVAC ANALYSIS   |     |        |     |        |    |        |     | 0      |    |        |     | 1      |    |        |    |
| 4.5.4   | PERFORM PRELIMINARY ELECTRICAL/ELECTRONIC STUDIES       |     |        |     |        |    |        |     |        |    |        |     |        |    |        |    |
| 4.5.4.1 | PRELIMINARY CABLEWAY LAYOUTS                            |     |        |     |        |    |        | 1   | 1 0    |    |        |     | 1      |    |        |    |
| 4.5.4.2 | CABLE ESTIMATES   |     |        |     |        |    |        |     | 1 0    |    |        |     |        |    |        |    |
| 4.5.4.3 | PRELIMINARY EQUIPMENT SELECTION AND LONG LEAD TIME LIST |     |        |     |        |    |        |     | 1 0    |    |        |     |        |    |        |    |
| 4.5.4.4 | PRELIMINARY LOAD SUMMARY/FAULT CURRENT                  |     |        |     |        |    |        |     | 1 0    |    |        |     |        |    |        |    |

# CASDAC LEVEL IV I/O MATRIX

|  | MGT.<br>SYSTEM<br>IV<br><u>4.1</u> | CAMDAC<br>IV<br><u>4.2</u> | HULDAC<br>IV<br><u>4.3</u> | CAPDAC<br>IV<br><u>4.4</u> | ELXDAC<br>IV<br><u>4.5</u> | HANDAC<br>IV<br><u>4.6</u> | CAVDAC<br>IV<br><u>4.7</u> | DESIGN<br>INTEG.<br>IV<br><u>4.8</u> |
|--|------------------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|--------------------------------------|
| 4.5.4.5 PRELIMINARY SYSTEM SKETCHES              |                                    |                            |                            |                            | 1                          |                            |                            |                                      |
| 4.5.4.6 PRELIMINARY HVAC STUDIES                 |                                    |                            |                            | 1                          | 1 0                        |                            | 1                          |                                      |
| 4.5.4.7 PREPARE WEIGHT AND MOMENT ESTIMATE       |                                    |                            | 1                          |                            | 0                          |                            |                            |                                      |
| 4.5.5 WIREWAY SIZING AND ROUTING                 |                                    | 0                          | 1 0                        | 1                          | 1 0                        |                            |                            |                                      |
| 4.5.5.1 CABLE HANGER DETAILS                     |                                    |                            | 0                          |                            | 0                          |                            |                            |                                      |
| 4.5.5.2 WIREWAY DETAILS                          |                                    |                            | 1 0                        |                            | 1 0                        |                            |                            |                                      |
| 4.5.5.3 POWER SYSTEM DECK PLANS                  |                                    | 0                          | 0                          |                            | 1 0                        |                            | 1 0                        |                                      |
| 4.5.5.4 TRANSMISSION LINE DRAWINGS               |                                    |                            | 1 0                        | 1                          | 1 0                        |                            |                            |                                      |
| 4.5.5.5 CABLE HEATING DISSIPATION                |                                    |                            |                            |                            | 1 0                        |                            |                            |                                      |
| 4.5.5.6 CABLE SEPARATION REQUIREMENTS            |                                    |                            | 1                          |                            | 1 0                        |                            |                            |                                      |
| 4.5.5.7 EMI/GROUNDING REQUIREMENTS               |                                    |                            |                            |                            | 1 0                        |                            |                            |                                      |
| 4.5.5.8 LIGHTING SYSTEM DECK PLANS               |                                    | 0                          | 0                          |                            | 1 0                        |                            |                            |                                      |
| 4.5.6 TEST PROCEDURES                            |                                    |                            |                            |                            | 0                          |                            |                            |                                      |
| 4.5.7 PREPARE PROCUREMENT SPECIFICATIONS FOR CFE |                                    |                            |                            |                            | 0                          |                            |                            |                                      |
| 4.5.7.1 CONSOLES                                 |                                    |                            |                            |                            | 0                          |                            |                            |                                      |
| 4.5.7.2 IC/ACO SWITCHBOARD                       |                                    |                            |                            |                            | 1 0                        |                            |                            |                                      |
| 4.5.7.3 POWER MC SETS                            |                                    |                            |                            |                            | 0                          |                            |                            |                                      |



# CASDAC LEVEL IV I/O MATRIX

|  | MGT.<br>SYSTEM<br>IV | CASDAC<br>IV | HULDAC<br>IV | CAPDAC<br>IV | ELXDAC<br>IV | HANDAC<br>IV | CAVDAC<br>IV | DESIGN<br>INTEG.<br>IV |
|--|----------------------|--------------|--------------|--------------|--------------|--------------|--------------|------------------------|
| 4.5.8  | 4.1                  | 4.2          | 4.3          | 4.4          | 4.5          | 4.6          | 4.7          | 4.8                    |
| PREPARE OPERATIONAL DOCUMENTS                  |                      |              |              |              | 0            |              |              |                        |
| 4.5.8.1  |                      |              |              |              | 0            |              |              |                        |
| LABEL PLATES REQUIREMENT                       |                      |              |              |              |              |              |              |                        |
| 4.5.8.2  |                      |              |              |              | 1 0          |              |              |                        |
| WARNING/HAZARD SIGNS                           |                      |              |              |              |              |              |              |                        |
| 4.5.8.3  |                      |              |              |              | 1 0          |              |              |                        |
| SHIP'S INFORMATION BOOKS                       |                      |              |              |              |              |              |              |                        |
| 4.5.8.4  |                      |              |              |              | 1 0          |              |              |                        |
| EQUIPMENT OPERATING INSTRUCTIONS               |                      |              |              |              |              |              |              |                        |
| 4.6  |                      |              |              |              |              |              |              |                        |
| HANDAC LEVEL IV                                |                      |              |              |              |              |              |              |                        |
| 4.6.1  |                      | 0            | 0            |              | 1 0          |              | 0            |                        |
| 4.6.2  |                      |              |              |              |              |              |              |                        |
| 4.7  |                      | 1 0          | 0            | 0            | 1 0          |              |              |                        |
| CAVDAC LEVEL IV                                |                      |              |              |              |              |              |              |                        |
| 4.7.1  |                      |              |              |              |              |              | 1            |                        |
| ANALYZE INSULATION REQUIREMENTS                |                      |              |              |              |              |              |              |                        |
| 4.7.1.1  |                      |              | 1            |              |              |              | 1            |                        |
| HULL INSULATION REQUIREMENTS                   |                      |              |              |              |              |              |              |                        |
| 4.7.1.2  |                      | 0            | 1            |              |              |              | 1            |                        |
| REFRIGERATION INSULATION REQUIREMENTS          |                      |              |              |              |              |              |              |                        |
| 4.7.1.3  |                      |              | 1            |              |              |              | 1            |                        |
| FIRE INSULATION REQUIREMENTS                   |                      |              |              |              |              |              |              |                        |
| 4.7.2  |                      |              |              |              | 0            |              | 1            |                        |
| PERFORM PRELIMINARY HVAC STUDIES               |                      |              |              |              |              |              |              |                        |
| 4.7.2.1  |                      |              |              |              |              |              | 1 0          |                        |
| PREPARE ROUGH HVAC DIAGRAM                     |                      |              |              |              |              |              |              |                        |
| 4.7.2.2  |                      |              |              |              |              |              | 1 0          |                        |
| PERFORM PRELIMINARY PRESSURE DROP CALCULATIONS |                      |              |              |              |              |              |              |                        |
| 4.7.2.3  |                      |              | 1            |              |              |              | 0            |                        |
| PREPARE WEIGHT AND MOMENT ESTIMATES            |                      |              |              |              |              |              |              |                        |

CASDAC LEVEL IV I/O MATRIX

|           | MCT.  |     | CAMDAC |     | HULDAC |     | CAPDAC |     | ELXDAC |     | HANDAC |     | CAVDAC |     | DESIGN |     |
|-----------|---|-----|--------|-----|--------|-----|--------|-----|--------|-----|--------|-----|--------|-----|--------|-----|
|           | SYSTEM  | IV  | IV     | 4.2 | IV     | 4.3 | IV     | 4.4 | IV     | 4.5 | IV     | 4.6 | IV     | 4.7 | IV     | 4.8 |
| 4.7.2.2.4 | PREPARE PRELIMINARY LISTS OF MATERIALS                          | 4.1 |        | 4.2 |        | 4.3 |        | 4.4 |        | 4.5 |        | 4.6 |        | 4.7 |        | 4.8 |
| 4.7.2.2.5 | PREPARE HVAC INSTRUCTIONS                                       |     |        |     |        |     |        |     |        |     |        |     |        |     | 1 0    |     |
| 4.7.3     | CALCULATE HEATING AND COOLING LOADS AND PERFORM SYSTEM ANALYSIS |     |        | 1 0 |        |     |        |     |        | 0   |        |     |        |     | 1 0    |     |
| 4.7.3.1   | CALCULATE HEATING AND COOLING LOADS                             |     |        | 0   |        | 0   |        |     |        | 0   |        |     |        |     | 1 0    |     |
| 4.7.3.2   | CALCULATE AIR QUANTITIES FOR NON-AIR-CONDITIONED COMPARTMENTS   |     |        |     |        |     |        |     |        |     |        |     |        |     | 1 0    |     |
| 4.7.3.3   | COOLING COIL RECAPITULATION CONVENTIONAL CALCULATIONS           |     |        |     |        |     |        |     |        |     |        |     |        |     | 1 0    |     |
| 4.7.3.4   | PERFORM HEATING ANALYSIS AND SIZE HEATERS                       |     |        |     |        |     |        |     |        | 1 0 |        |     |        |     | 1 0    |     |
| 4.7.4     | PREPARE FINISHED DIAGRAMMATIC AND EQUIPMENT LIST                |     |        |     |        |     |        |     |        |     |        |     |        |     | 1 0    |     |
| 4.7.4.1   | PREPARE HVAC DIAGRAMMATIC                                       |     |        |     |        | 1   |        | 1   |        |     |        |     |        |     | 1 0    |     |
| 4.7.4.2   | PREPARE HVAC EQUIPMENT LIST                                     |     |        |     |        |     |        |     |        |     |        |     |        |     | 1 0    |     |
| 4.7.5     | ARRANGEMENT OF FAN ROOMS AND MAJOR VENT TRUNKS                  |     |        |     |        |     |        |     |        |     |        |     |        |     | 1 0    |     |
| 4.7.5.1   | PREPARE FAN ROOM ARRANGEMENT DRAWINGS                           |     |        |     |        | 1   |        |     |        |     |        |     |        |     | 1 0    |     |
| 4.7.5.2   | PREPARE DRAWINGS FOR MAJOR VENTILATION TRUNKS                   |     |        |     |        | 1   |        |     |        |     |        |     |        |     | 1 0    |     |
| 4.7.6     | ROUTE AND SIZE DUCTS  |     |        |     |        | 0   |        |     |        |     |        |     |        |     | 1 0    |     |
| 4.7.6.1   | PREPARE SINGLE LINE ROUTING                                     |     |        |     |        | 1 0 |        |     |        |     |        |     |        |     | 1 0    |     |
| 4.7.6.2   | CALCULATE PRESSURE DROPS AND SIZE DUCTING                       |     |        |     |        |     |        |     |        |     |        |     |        |     | 1 0    |     |

# CASDAC LEVEL IV I/O MATRIX

|         | MGT.   |    | CAMDAC |     | HULDAC |     | CAPDAC |     | ELXDAC |     | HANDAC |     | CAVDAC |     | DESIGN |     |
|---------|--|----|--------|-----|--------|-----|--------|-----|--------|-----|--------|-----|--------|-----|--------|-----|
|         | SYSTEM   | IV | IV     | 4.2 | IV     | 4.3 | IV     | 4.4 | IV     | 4.5 | IV     | 4.6 | IV     | 4.7 | IV     | 4.8 |
| 4.7.7   |  |    |        |     |        |     |        |     |        |     |        |     |        |     |        |     |
|         | PREPARE ARRANGEMENT DRAWINGS AND BILLS OF MATERIAL |    |        |     |        |     |        |     |        |     |        |     |        |     |        |     |
| 4.7.7.1 |  |    |        | 1   |        |     |        |     |        | 1   |        |     |        | 1   | 0      |     |
| 4.7.7.2 |  |    |        |     |        |     |        |     |        |     |        |     |        | 0   |        |     |
|         | PREPARE LABEL PLATE AND BLANK FLANGE LISTS         |    |        |     |        |     |        |     |        |     |        |     |        |     |        |     |
| 4.7.8   |  |    |        |     |        |     |        |     |        |     |        |     |        | 0   |        |     |
|         | HVAC TESTS   |    |        |     |        |     |        |     |        |     |        |     |        |     |        |     |
| 4.8     |  |    |        |     |        | 1   | 0      |     |        | 1   | 0      |     |        | 1   |        |     |
|         | DESIGN INTEGRATION LEVE                            |    |        |     |        |     |        |     |        |     |        |     |        |     |        |     |
|         | OUTSIDE OF LEVEL IV                                |    |        |     |        |     |        |     |        |     |        |     |        |     |        |     |
| E.4     |  |    |        |     |        |     |        |     |        |     |        |     |        |     |        |     |
|         | USCC   |    |        |     |        |     |        |     |        |     |        |     |        |     |        |     |
| E.1.2   |  |    |        |     |        |     | 1      | 0   |        |     |        |     |        | 0   |        |     |
|         | DESIGN REVIEW AND APPROVAL                         |    |        |     |        |     |        |     |        |     |        |     |        |     |        |     |
| E.1.4   |  |    |        |     |        |     | 1      | 0   |        |     |        |     |        |     |        |     |
|         | DESIGN CHANGE ADMINISTRATION                       |    |        |     |        |     |        |     |        |     |        |     |        |     |        |     |
| E.1.5   |  |    |        |     |        |     | 1      |     |        |     |        |     |        | 1   | 0      |     |
|         | GFE, GFI, GFS                                      |    |        |     |        |     |        |     |        |     |        |     |        |     |        |     |
| E.2     |  |    |        |     |        |     | 1      |     |        |     |        |     |        | 1   | 0      |     |
|         | VENDORS  |    |        |     |        |     |        |     |        |     |        |     |        |     |        |     |
| E.3.1   |  |    |        |     |        |     | 1      |     |        |     |        |     |        | 1   | 0      |     |
|         | PROJECT CONTROL                                    |    |        |     |        |     |        |     |        |     |        |     |        |     |        |     |
| 3       |  |    |        |     |        |     | 1      |     |        |     |        |     |        | 1   | 0      |     |
|         | CASDAC III   |    |        |     |        |     |        |     |        |     |        |     |        |     |        |     |
| 5.4     |  |    |        |     |        |     | 1      |     |        |     |        |     |        | 1   | 0      |     |
|         | CAPDAC V   |    |        |     |        |     |        |     |        |     |        |     |        |     |        |     |
| E.3.2   |  |    |        |     |        |     | 1      |     |        |     |        |     |        | 1   | 0      |     |
|         | PROCUREMENT  |    |        |     |        |     |        |     |        |     |        |     |        |     |        |     |
|         | NAVSHIPS 0948-7010                                 |    |        |     |        |     |        |     |        |     |        |     |        |     |        |     |
| E.1.3   |  |    |        |     |        |     | 0      |     |        |     |        |     |        | 0   |        |     |
|         | INSPECTION AND TESTING                             |    |        |     |        |     |        |     |        |     |        |     |        |     |        |     |

# CASDAG LEVEL IV I/O MATRIX

|       | MGT.                             |     | CAMDAC |     | HULDAC |     | CAPDAC |     | ELXDAC |    | HANDAC |    | CAVDAC |    | DESIGN |    |
|-------|----------------------------------|-----|--------|-----|--------|-----|--------|-----|--------|----|--------|----|--------|----|--------|----|
|       | SYSTEM                           | IV  | IV     | IV  | IV     | IV  | IV     | IV  | IV     | IV | IV     | IV | IV     | IV | IV     | IV |
|       | 4.1                              | 4.2 | 4.3    | 4.4 | 4.5    | 4.6 | 4.7    | 4.8 |        |    |        |    |        |    |        |    |
| E.3   | SHIPYARD ENVIRONMENTAL FUNCTIONS |     |        |     |        |     |        |     |        |    |        |    |        |    |        |    |
| S.6   | HANDAC V                         |     |        |     |        |     |        |     |        |    |        |    |        |    |        |    |
| S.7   | CAVDAC V                         |     |        |     |        |     |        |     |        |    |        |    |        |    |        |    |
| S.2   | CAMDAC V                         |     |        |     |        |     |        |     |        |    |        |    |        |    |        |    |
| E.2.2 |                                  |     |        |     |        |     |        |     |        |    |        |    |        |    |        |    |
| S.3   | HULDAC V                         |     |        |     |        |     |        |     |        |    |        |    |        |    |        |    |
| E.1.7 | CONTRACT CLOSE OUT               |     |        |     |        |     |        |     |        |    |        |    |        |    |        |    |
| E.1   | NAVY CONTRACT ADMINISTRATION     |     |        |     |        |     |        |     |        |    |        |    |        |    |        |    |
| S.5   | CASDAG LEVEL 5 ELXDAC V          |     |        |     |        |     |        |     |        |    |        |    |        |    |        |    |

APPENDIX E

I/O DOCUMENT LIST

## CAMDAC INPUTS

D = Document; MI = Machinery (CAMDAC) Input

- D.MI.1            Contract Data
  - D.MI.1.1        Detail Specifications
  - .2     Contract and Guidance Drawings
  - .3     Vendor Data
- D.MI.2            Machinery Design Information
  - D.MI.2.1        Plan Schedule
  - .2     Propulsion Controls
  - .3     Power, RPM, Orientation
  - .4     Machinery Arrangement
  - .5     Machinery List
  - .6     Waste Heat Data
  - .7     Special Procurement Data
  - .8     Component Drawings
  - .9     Detail Machinery Drawings
  - .10    Condenser Scoop
  - .11    Bureau of Ships Technical Manuals
  - .12    Component and Plant Operating Data
  - .13    Equipment Operating Instructions
  - .14    Detail Arrangement Drawings
  - .15    EQ Casualty Reports
  - .16    Design Integration

CAMDAC INPUTS (continued)

- D.MI.3           Interface Data
  - D.MI.3.1       Hull Interface Data
    - D.MI.3.1.1   Compartment and Access Drawings
    - .2   Structural Drawings
    - .3   Molded Hull Form
    - .4   Noise Reduction Acoustic Treatment
    - .5   Hydrodynamic Review
  - D.MI.3.2       Electrical/Electronics Interface Data
    - D.MI.3.2.1   Degaussing Coils
    - .2   Arrangement of Electrical Equipment
    - .3   Cableways
  - D.MI.3.3       Piping Interface Data
    - D.MI.3.3.1   Piping Diagrammatics
    - .2   Piping Diagrams
    - .3   Detail Arrangement Drawings
  - D.MI.3.4       HVAC Interface Data
    - D.MI.3.4.1   Ventilation Ducts
    - .2   HVAC Arrangement Drawings
    - .3   Combustion Air and Uptakes

## CAMDAC OUTPUT

D = Document; MO = Machinery (CAMDAC) Output

- D.MO.1 Machinery List, Interfaces Data, Procurement Data
  - D.MO.1.1 Propulsion Plant Machinery List
    - D.MO.1.1.1 Steam Propulsion Plant Machinery List
    - .2 Diesel Propulsion Plant Machinery List
    - .3 Gas Turbine Propulsion Plant Machinery List
    - .4 Power Transmission Components Machinery List
    - .5 Auxiliary, Secondary, and Emergency Propulsion System Machinery List
    - .6 Propulsion Control Components Machinery List
  - D.MO.1.2 Auxiliary System Machinery List
    - D.MO.1.2.1 Refrigeration Plant Machinery List
    - .2 Distilling Plant Machinery List
    - .3 Auxilliary Boiler
    - .4 O<sub>2</sub>N<sub>2</sub> Plant
    - .5 Steering Gear
  - D.MO.1.3 Electrical System Support Machinery List
    - D.MO.1.3.1 Ship Service Generator Machinery List
    - .2 Emergency Ship Service Generator Machinery List
  - D.MO.1.4 Parts Allowance List
- D.MO.2 Drawings
  - D.MO.2.1 Arrangement Drawings
    - D.MO.2.1.1 Machinery Space Arrangement Drawings



CAMDAC OUTPUT (continued)

- D.MO.2.1.2 Combustion Air and Uptakes Arrangement Drawing and Bill of Material
- .3 Condenser Scoop Arrangement Drawing and Bill of Material
- D.MO.2.2 Detail Machinery Drawings
  - D.MO.2.2.1 Detail Drawings and Bill of Material
- D.MO.3 Instructions
  - D.MO.3.1 Operating Instructions
    - .2 Safety Precautions
    - .3 Mounting Instructions
    - .4 Manufacturer
    - .5 Scheduled Maintenance Instructions
- D.MO.4 Test
  - D.MO.4.1 Test Memoranda
    - .2 Test Results
- D.MO.5 Label Plates
  - D.MO.5.1 Label Plate Text
    - .2 Label Plate Manufacturer's Specifications
    - .3 Label Plate Mounting Instructions

## CAPDAC INPUTS

D = Document; PI = Piping (CAPDAC) Input

- D.PI.1            Contract Data
  - D.PI.1.1        Detail Specifications
    - .2            Contract Drawings
    - .3            MIL Specifications
    - .4            MIL Standards
      - D.PI.1.4.1    MIL Standard 777
      - .2            MIL STD 438
- D.PI.2            Piping Design Information
  - D.PI.2.1        List of Piping Systems
    - .2            Preliminary Piping Diagrams
    - .3            Preliminary Piping Arrangement Drawings
    - .4            Preliminary Piping Lists of Material
    - .5            Piping Component Dimensions
    - .6            Valve Operating Gear Design Data
    - .7            Library of Joint I.D. Numbers
    - .8            Hanger Loads
    - .9            Library of Test Specifications
    - .10           Library of Process Instructions
    - .11           Standard Notes
    - .12           Operating Data
    - .13           Component Technical Manuals
    - .14           Label Plate Standards

CAPDAC INPUTS (continued)

- .15 Composite Drawings
- .16 Human Factor Engineering Data
- .17 Design Integration
- D.PI.3 Shop Fabricating Data
  - D.PI.3.1 Welding Data
    - .2 Brazing Data
    - .3 Radiography Data
    - .4 Tooling Data
- D.PI.4 Material Control
  - D.PI.4.1 Material Catalog
    - .2 Catalog of Pipe Hangers, Sway Braces, etc.
    - .3 Catalog of Attachment Hardware
    - .4 Valve Operating Gear Catalog
    - .5 Pipe Material Master Catalog File
- D.PI.5 Interface Data
  - D.PI.5.1 Hull Interface Data
    - D.PI.5.1.1 Molded Hull Form
      - .2 Structural Drawings
      - .3 Compartment and Access Drawings
  - D.PI.5.2 Machinery Interface Data
    - D.PI.5.2.1 Machinery List
      - .2 Machinery Arrangements

CAPDAC INPUTS (continued)

D.PI.5.3 HVAC Interface Data

D.PI.5.3.1 HVAC Diagrammatics

.2 Vent Drawings

D.PI.5.4 Electrical/Electronics Interface Data

D.PI.5.4.1 Electrical Equipment and Wireway Drawings

.2 Electrical/Electronics Diagrams

## CAPDAC OUTPUT

D = Document; PO = Piping (CAPDAC) Output

- D.PO.1 Drawings
  - D.PO.1.1 Piping Diagram Drawings
    - .2 Composite Drawings
    - .3 Piping Arrangement Drawings
    - .4 Quality Assurance Drawing
  - D.PO.1.4.1 Joint I.D. Drawing
    - .2 Table of Joints and Notes
    - .3 List of Unassigned Joint ID's or Deleted ID's
  - D.PO.1.5 Pipe Detail Drawings
    - .6 Pipe Hanger Arrangement Drawing
    - .7 Pipe Hanger Detail Drawings
    - .8 Open Gear Arrangement Drawing
    - .9 Open Gear Detail Drawing
    - .10 Label Plate Format
- D.PO.2 Lists
  - D.PO.2.1 Piping List of Material
    - .2 Material List for Pipe Details
    - .3 Pipe Hanger List of Material
    - .4 Open Gear List of Material
    - .5 Label Plate List Pipe Systems
    - .6 Label Plate List Pipe Components
    - .7 List of Test

CAPDAC OUTPUT (continued)

|          |                            |
|----------|----------------------------|
| D.PO.2.8 | List of Locks              |
| .9       | List of Hoses              |
| .10      | List of, etc.              |
| D.PO.3   | Instructions               |
| D.PO.3.1 | Fabrication Instructions   |
| .2       | Installation Schedule      |
| D.PO.4   | Tests                      |
| D.PO.4.1 | Test Specifications        |
| .2       | Test Results               |
|          | Procurement Specifications |
|          | Interfaces                 |

## CAVDAC INPUTS

D = Document; VI = Ventilation (CAVDAC) Input

- D.VI.1            Contract Data
  - D.VI.1.1        Detail Specifications
  - .2        Contract and Guidance Drawings
- D.VI.2            HVAC Design Information
  - D.VI.2.1        General Arrangement, HVAC Diagrams and System Scantlings
  - .2        Heating and Cooling Loads
  - .3        System Analysis
  - .4        Rough HVAC Diagram:
  - .5        Ducting Sizes
  - .6        Preliminary List of Materials
  - .7        Standards
  - .8        Composite Drawings
  - .9        Preliminary HVAC Studies
  - .10       List of Ships Equipment and Heat Dissipation
  - .11       Construction Design Temperatures and Insulation Requirements
  - .12       Personnel Heat
  - .13       Cooling Loads
  - .14       Routing and Sizing of Ducts
  - .15       Air Quantities
  - .16       Cooling Coil Sizes
  - .17       Ventilation Requirements
  - .18       HVAC Instructions

## CAVDAC INPUTS (continued)

- .19 Insulation
- .20 HVAC Diagrammatics
- .21 Design Integration
- .22 Fan Room Arrangement and Trunk Sizes
- .23 Component Sizes
- .24 Preliminary Duct Sizes
- .25 Single Line Routing
- .26 Pressure Drop Calculations
- .27 HVAC Arrangement Drawings and Lists of Material
- D.VI.3 Interface Data
  - D.VI.3.1 Hull Interface
    - D.VI.3.1.1 Compartment and Access Drawings
      - .2 Hull Arrangement Drawings
      - .3 Insulation Requirements
      - .4 Structural Drawings
      - .5 Noise Reduction and Acoustic Treatment Analysis
      - .6 Structural Detail Design
      - .7 Major Ventilation Trunk Drawings
    - D.VI.3.2 Electrical/Electronics Interface
      - D.VI.3.2.1 Compartment Lighting
        - .2 Compartment Machinery/Equipment Heat Loads
    - D.VI.3.3 Piping Interface



CAVDAC INPUTS (continued)

- D.VI.3.3.1 Air Conditioning Chilled Water Circulation System
- D.VI.3.4 Machinery Interface
  - D.VI.3.4.1 Machinery Arrangement Drawings
  - .2 Main Machinery, Pump Room, Refrigeration and Miscellaneous Machinery Room Arrangement

## CAVDAC OUTPUT

D = Document; VO = Ventilation (CAVDAC) Output

- D.VO.1 Heating, Ventilation and Air Conditioning Drawings
  - D.VO.1.1 Preliminary HVAC Diagrammatic
    - D.VO.1.1.1 Preliminary Duct Sizes
  - D.VO.1.2 Rough HVAC Diagrammatic
  - D.VO.1.3 HVAC Diagrammatic Drawings
  - D.VO.1.4 Fan Room Arrangement Drawing
  - D.VO.1.5 Major Ventilation Trunk Drawing
  - D.VO.1.6 Single Line Routing Drawings
  - D.VO.1.7 HVAC Arrangement and Detail Drawings and List of Material
- D.VO.2 Instructions
  - D.VO.2.1 HVAC Instructions (Insulation, Fabrication and Installation)
- D.VO.3 CAVDAC List
  - D.VO.3.1 Insulation List
    - D.VO.3.1.1 Compartment Insulation List
    - .2 Refrigeration Insulation List
    - .3 Fire Insulation List
  - D.VO.3.2 Design Temperatures List
  - D.VO.3.3 Fire Boundaries List
  - D.VO.3.4 HVAC Equipment List
    - D.VO.3.4.1 Fan List
    - .2 Steam and Electric Heater List

CAVDAC OUTPUT (continued)

- .3 Convector Heater List
- .4 Cooling Coil List
- .5 Flame Arrester List
- .6 Air Filter List
- .7 Valve List
- D.VO.3.5 Preliminary HVAC Lists of Material
  - D.VO.3.5.1 HVAC Lists of Material
- D.VO.3.6 HVAC Sizes of Components
- D.VO.3.7 Miscellaneous HVAC List
- D.VO.4 Calculations CAVDAC
  - D.VO.4.1 Insulation Analysis
    - .2 Compartment and Total Cooling and Heating Loads
    - .3 Ventilation Requirements (List)
    - .4 Cooling Coil Sizes
    - .5 Air Quantities
    - .6 Reheater Groupings (List)
    - .7 Pressure Drop Calculations (Duct Sizes)
    - .8 Fan Sizes (List)
    - .9 Preheaters (List)
    - .10 Heaters (List)
    - .11 Ventilation Trunk Analysis
    - .12 Final Pressure Drop Calculations (Duct Sizes)

CAVDAC OUTPUT (continued)

|          |                                 |
|----------|---------------------------------|
| D.VO.5   | Interface Data                  |
| D.VO.5.1 | Foundation Design Information   |
| D.VO.6   | Test                            |
| D.VO.6.1 | Test Specifications             |
| D.VO.6.2 | Test Reports                    |
| D.VO.7   | Weight Control                  |
| D.VO.7.1 | HVAC Weight and Moment Estimate |

## ELXDAC INPUTS

D = Document; EI = Electrical/Electronics (ELXDAC) Input

- D.EI.1            Contract Data
  - D.EI.1.1        Detail Specifications
  - .2            Contract and Guidance Drawings
  - .3            GFE, GFI
  - .4            Vendor Data
- D.EI.2            Electrical/Electronics Design Information
  - D.EI.2.1        Preliminary Electrical/Electronics Studies
    - .2            Preliminary Cableway Layouts
    - .3            Preliminary Analysis
    - .4            Preliminary Cable Estimates
    - .5            Preliminary Equipment List and Long Lead Items
    - .6            Preliminary Fault Current
    - .7            Preliminary Voltage Drop
    - .8            Preliminary System Sketches
    - .9            Antenna Arrangements
    - .10           Power System Deck Plans
    - .11           Lighting System Deck Drawings
    - .12           Isometric Drawings
    - .13           Wireway Sizing and Routing
    - .14           Wireway Drawings
    - .15           Electronics System Drawings
    - .16           Ship System Drawings

ELXDAC INPUTS (continued)

- .17 Navigation Light Requirements
- .18 Telephone Directory
- .19 Load Shedding
- .20 Design Division Instructions
- .21 Equipment Operating Instructions
- .22 Waveguide/Transmission Drawings
- .23 Procurement Specifications for CFE, IC/ACO Switchboard
- .24 Arrangement Drawings
- .25 Warning/Hazard Signs
- .26 Sizing of Components
- .27 Schematic Drawings
- .28 EMI/Grounding Requirements
- .29 Elementary Drawings
- .30 Arrangement of Major Electronics Spaces
- .31 Running Lights Arrangement
- .32 Synchro Loads
- .33 Load Balancing Summaries
- .34 Cable Estimates
- .35 Cable Heating Dissipation
- .36 Cable Catalogs
- .37 Hook-Up Lists
- .38 Ship's Information Books

## ELXDAC INPUTS (continued)

- .39 Design Integration
- .40 Change Orders
- D.EI.3 Interface Data
  - D.EI.3.1 Hull Interface
    - D.EI.3.1.1 Hull Structure
      - .2 Compartment and Access Drawings
      - .3 Mast Structure
      - .4 Deckhouse Structure
      - .5 Mast Design
      - .6 Hull System Engineering
      - .7 Structure Detail Design
  - D.EI.3.2 Piping Interface
    - D.EI.3.2.1 Piping Arrangement Drawings
      - .2 Composite Drawings
  - D.EI.3.3 Machinery Interface
    - D.EI.3.3.1 Machinery List
      - .2 Auxiliary Machinery List
      - .3 Ships Service Machinery List
  - D.EI.3.4 HVAC Interface
    - D.EI.3.4.1 Preliminary HVAC Studies

## ELXDAC OUTPUT

D = Document; EO = Electrical/Electronics Output

- D.EO.1 Drawings
  - D.EO.1.1 Arrangement Drawings
    - D.EO.1.1.1 Major Electronics Spaces Drawings
      - .2 Antenna Arrangement Drawing
      - .3 Running Lights Arrangement Drawings
      - .4 Electrical Composite Deck Drawings
  - D.EO.1.2 Elementary Wiring Diagrams
    - .3 One-Line Diagrams
    - .4 Block Diagrams
    - .5 Isometric Drawings and Lists of Material
    - .6 Standard Method Drawings
    - .7 Illumination Survey Drawings
    - .8 Preliminary Cable Run Drawings
    - .9 Preliminary System Sketches
    - .10 Wireway Sizing
      - D.EO.1.10.1 Wireway Details
        - .2 Cable Hanger Details
        - .3 Main Cableway Layouts
  - D.EO.1.11 Power System Deck Drawings
    - .12 Transmission Line Drawings
    - .13 Cable Routes/Sizes
    - .14 Transit Sizes and Cable Assignments



ELXDAC OUTPUT (continued)

- .15 Lighting System Deck Drawings
- D.EO.2 Test Data
  - D.EO.2.1 Test Specifications
  - .2 Test Procedures
- D.EO.3 Procurement Specifications
  - D.EO.3.1 Procurement Specifications for CFE
  - .2 Procurement Specifications for Consoles
  - .3 Procurement Specifications for IC/ACO Switchboard
  - .4 Procurement Specifications for Power MG Sets
  - .5 Cable Estimates for Early Procurement
- D.EO.4 Systems Analysis and Calculations
  - D.EO.4.1 Initial Engineering Data
  - .2 Preliminary Analysis
  - .3 System Loads
  - .4 Size of Components and Cables
  - .5 Analysis and Calculations
    - D.EO.4.5.1 Fault Current Analysis
    - .2 Voltage Drop Analysis
    - .3 Synchro Load Analysis
- D.EO.5 Operational Documents
  - D.EO.5.1 Design Division Instructions
  - .2 Shut-Down Instructions
  - .3 EMI/Grounding Instructions

ELXDAC OUTPUT (continued)

- .4 Equipment Operating Instructions
- .5 Label Plates
- D.EO.5.5.1 Inscriptions
  - .2 Format
  - .3 Lists
  - .4 Mounting Instructions
- D.EO.5.6 Warning/Hazard Signs
  - D.EO.5.6.1 Inscriptions
    - .2 Format
    - .3 Lists
    - .4 Mounting Instructions
- D.EO.5.7 Ship's Information Book
- D.EO.6 Interface Data
  - D.EO.6.1 Preliminary HVAC Requirements
    - .2 HVAC Requirements
    - .3 Foundation Requirements
    - .4 Power Requirements
    - .5 Weight of Moment Data
- D.EO.7 Lists
  - D.EO.7.1 Equipment Lists
    - .2 Hook-Up Lists
    - .3 Preliminary Equipment List (Long-Lead Time Items)
    - .4 Telephone Directory

## HULDAC INPUTS

D = Document; HI = Hull (HULDAC) Input

- D.HI.1            Contract Data
  - D.HI.1.1        Detail Specifications
    - .2            Contract and Guidance Drawings
  - D.HI.1.2.1      Shell Expansion Level III
    - .2            Molded Hull Form Level III
    - .3            Compartment and Access Drawings, Level III
  - D.HI.1.3        GFE, GFI
    - .4            Vendor Data
  - D.HI.1.4.1      Vendor Drawings
    - .2            Commercial Catalogs
    - .3            Technical Manuals
  - D.HI.1.5        Change Data
- D.HI.2           Structural Engineering Data
  - D.HI.2.1        Engineering Schedule
    - .2            Engineering Plan
    - .3            Design Approval
    - .4            Design Error Notes
- D.HI.3           Structural Detail Design Documents
  - D.HI.3.1        Detail Design Schedule
    - .2            Erection Schedule
    - .3            Identification Standards
    - .4            Quality Assurance Procedures

## HULDAC INPUTS (continued)

- D.HI.4            Weight Data
  - D.HI.4.1        Preliminary Weight Estimate
  - .2               Accepted Weight Report
  - .3               HVAC Weight Estimate
  - .4               Structural Detail Design Weight Data
  - .5               Machinery Weight Data
  - .6               Piping Weight Data
  - .7               Electrical/Electronics Weight Data
  - .8               Insulation Weight Data
  - .9               Combustion Air and Uptake Weight Data
  - .10              Condenser Scoop Weight Data
- D.HI.5           Drawings
  - D.HI.5.1        Molded Hull Form
  - .2               Decks, Platforms, Main Bulkhead and Framing Drawings
  - .3               Structural Arrangement Drawings
  - .4               Superstructure Structural Arrangement Drawings
  - .5               Structural Deckhouse Detail Drawings
  - .6               Miscellaneous Structural Bulkhead Drawings
  - .7               Non-Structural Bulkhead Drawings
  - .8               Compartment and Access Drawings
  - .9               Deck Covering
  - .10              Ship's Insulation

## HULDAC INPUTS (continued)

- .11 Sheathing
- .12 Compartment Lighting Drawings
- .13 Main Cableway Deck Arrangement Drawings
- .14 HVAC Duct Arrangement Drawings
- .15 Plumbing System
- .16 Potable Water System
- .17 Piping Arrangement and Detail Drawings
- .18 Pipe Hanger, Pipe Diagram and Preliminary Arrangement Drawing
- .19 HVAC System Diagram
- .20 HVAC Penetrations
- .21 Vent Trunk Drawings
- .22 Fan Room Arrangement Drawings
- .23 Power System Diagrams
- .24 Main Cableway Routings
- .25 Machinery Arrangement Drawings
- .26 Machinery Detail Drawings
- .27 Combustion Air and Uptakes
- .28 Condenser Scoop
- D.HI.6 List
  - D.HI.6.1 Insulation Lists
  - .2 Compartment Insulation Lists
- D.HI.7 Material Data

HULDAC INPUTS (continued)

|          |                                       |
|----------|---------------------------------------|
| D.HI.7.1 | Purchase Specifications               |
| .2       | Purchase Orders                       |
| .3       | Receive Orders                        |
| D.HI.8   | Design Integration                    |
| D.HI.8.1 | Interface Data (Power Train)          |
| .2       | Interface Data (Auxiliary Propulsion) |

## HULDAC OUTPUT

D = Document; HO = Hull (HULDAC) Output

- D.HO.1            Structural Engineering Data
  - D.HO.1.1        Structural Engineering Drawings
    - D.HO.1.1.1     Molded Hull Form
      - .2    Shell Expansion
      - .3    Structural Arrangement Drawings
      - .4    Superstructure Arrangement Drawings
      - .5    Compartment and Access Drawings
  - D.HO.1.2        Structural Engineering Documents
    - D.HO.1.2.1     Engineering Schedule
      - .2    Docking Plan
      - .3    Technical Notes and Memoranda
      - .4    Surface and Stiffener Data
      - .5    Hydrodynamic Review
      - .6    Cross-Flooding Analysis
  - D.HO.1.3        Change Data
  - D.HO.1.4        Ship's Instruction Documents
- D.HO.2           Structural Detail Design Documents
  - D.HO.2.1        Detail Design Schedule
    - .2    Miscellaneous Detail Design Documents
    - .3    Outfit Drawings
  - S.HO.2.3.1      Commissary Space and Equipment Drawings
    - .2    Reefer Space Drawings

HULDAC OUTPUT (continued)

- .3 Storeroom Drawings
- .4 Living and Office Space Drawings
- .5 Utility and Workshop Space Drawings
- .6 Medical Space Drawings
- D.HO.2.4 Foundation Design Documents
- D.HO.3 Weight Control
  - D.HO.3.1 Weight Reports
- D.HO.4 Lists
  - D.HO.4.1 Holes List
  - .2 Access List
  - .3 Furniture List
  - .4 Advanced Material List
  - .5 Various Bills of Material
- D.HO.5 Material Data
  - D.HO.5.1 Purchase Specifications
  - .2 Comment Approval Letters
- D.HO.6 Test Data
  - D.HO.6.1 Testing Guidance



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